N.A.A.S.

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QUARTERLY REVIEW

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ARTICLES

EXPERIMENTAL HUSBANDRY FARMS: 1. TRAWSCOED

W. M. R. Evans
Farm Director

The Mansion and Home Farm at Trawscoed were purchased from the Earl of Lisburne in 1946, and since that time the Mansion has been used as the Welsh Provincial Centre. Possession of the farm was obtained in October, 1947, for development as an Experimental Husbandry Farm.

Prior to obtaining possession, the farmstead and 720 acres of the farm had been occupied by a tenant, a further 200 acres were let out in separate fields to nine neighbouring farmers, and the remaining 150 acres of woodland, etc., were retained by the Earl of Lisburne.

The previous tenant had practised milk production with a self-contained herd of Shorthorns, and a certain amount of summer fattening of cattle was done. In addition, a flock of Welsh mountain sheep was kept on the hill grazing.

Location and Climate

The farm lies in the Ystwyth Valley, which runs due east of Aberystwyth. The Ystwyth is a very small, turbulent river rising in the Plynlimmon Range, and until it reaches Trawscoed its course is very narrow. At this point the valley widens to approximately a mile. The Husbandry Farm is situated at this point, on the right bank between two small tributaries—the Afan and the Magwr—which enter the Ystwyth one mile apart.

With the exception of the western valley approach, the farm is surrounded by hills over 1,000 feet high.

Trawscoed is well served with a train and road service from Aberystwyth, which is eight miles away.

The location of the farm at the end of the broad portion of the valley has an important bearing on the climate. The warm air from the sea rises as it enters the valley, with the result that there are few days in the year when some rain does not fall. The annual rainfall is 50 inches. In 1948, during the 108 days from June 15 to September 30, which would normally constitute the harvest period, rain occurred in varying degrees on 66 days.

The climate is normally very mild, with a long grass-growing season, which extends well into December. Actually, during the winter of 1948-49 there was some growth on the leys during the normally dead period from January to March.

Three Main Types of Welsh Farmland

The estate extends to 1,070 acres, of which 570 acres is clean, ploughable land and 350 acres is enclosed hill grazing, rising to over 1,000 feet above sea level ; the remaining 150 acres include the decorative grounds of the Mansion, woodlands, etc. The farm lies within a ring fence, with the exception of one small field and, except for the hill, is enclosed within main roads. The general outline is that of a square with a village at each corner. (See Plate 8.)

Topographically, the land is very suitable for experimental purposes, as within one farm there exists a large area of each of the three main types of farmland met with in Wales.

The lowland, which extends to 378 acres, is rather typical of much of the lowland in the Principality. It runs from 100 to 200 feet above sea level, the soil being a medium loam with quite a proportion of shale, merging into alluvium in the lower reaches as it gets nearer the river. The fields extend from 15 to 30 acres, and are mainly flat but with some undulations. (See Plates 1 and 2.)

The second and intermediate type of land is typical of the greater part of Wales. This area extends to 192 acres and rises to 550 feet above sea level. Here the shales are much more in evidence, the soil is lighter, is very deficient in lime, and is generally hungry. The contour is much sharper and the fields are smaller, extending from 4 to 15 acres. (See Plate 3.)

The third type is the hill proper. This is essentially rough grazing with some bare rock, and extends to 350 acres. It rises to over 1,000 feet above sea level, is roughly conical in shape, and affords shelter for sheep from all winds in turn. (See Plate 3.)

The area represented by the intermediate type has a south-westerly aspect and lies north-east of the lowland. The hill in turn lies north-east again.

At the time of taking possession there were 140 acres in tillage, the bulk of which was over-cropped, worn out and dirty, the main weed being " docks ". Leys extended to 85 acres, but were generally less productive than the permanent pasture.

The hedges—where they exist—with the exception of the roadside had not been laid for some time and the banks were riddled with rabbit holes. In the main, the fences are of wire or of the iron parkland type. These latter are in good condition, but much of the wire fencing is in various stages of decay. The boundary fence on the hill was not stock-proof, and until a new fence was erected the Husbandry Farm was a grazing ground for the neighbours' sheep.

Drainage and Soil

Contrary to what one might expect at first sight, a considerable part of the farm is under-drained, the systems are very old and there are no plans. They are, however, mainly in good condition, but where repairs have had to be effected one has been amazed to find that even laterals are 4 feet deep.

This drainage water suitably controlled, together with small streams, effectively supplies stock water to most of the fields.

Soil analysis has been carried out by Dr. Rice Williams, the Provincial Chemist, and the following figures will give an idea of the level of fertility.

	Very Deficient	Deficient	Satisfactory
	acres	*acres*	*acres*
Lime	253	171	138
Phosphate	322	215	25
Potash	38	458	66

A soil survey has been carried out by Mr. Evan Roberts, Soil Chemist, Bangor Sub-Centre, who found that the soils are derived wholly from Silurian shales and grits. These can be sub-divided into hard shales and grits which give rise to soils of the Powis suite and the soft shales which give rise to soils of the Dinam suite.

There has been some glaciation of the whole area and quite an extensive fluvo-glacial plateau was formed by the junction of material brought down the valleys of the two rivers that join just south of Trawscoed. Through this, the course of the Ystwyth has changed and a more recent alluvial deposit formed.

Mr. Roberts has distinguished the following soil series in the area :

WORLD SOIL GROUPS	HARD SHALES	SOFT SHALES
Brown Earths	Powis	Dinam
	Penrhyn	Corwen
Meadow Soils	Sannan	Gwern
	Cegin	Ilar (name provisional)
Podsolic Soils	—	Cymmer
		Hiraethog (variant)
Peaty Podsolized Soils ..	—	Ynys
Alluvial Soils	Rheidol	Teifi (name provisional)
		Aeron (name provisional)

The lowland area is composed mainly of the Rheidol, Aeron and Teifi series, whilst the intermediate land is represented by the Dinam and Powis suites. The hill is represented almost completely by the Cymmer series.

Buildings

There are two ranges of buildings on the farm : the main farmstead and a modern range near the Mansion.

At the farmstead are the farmhouse, two cottages, and the farm buildings. Over a period of years, especially when the farm was the home farm of the estate, beef cattle-rearing had been the main enterprise. It is not surprising, therefore, that the farm buildings consist mainly of stock-yards and loose-boxes. The buildings are grouped around a square concrete yard bounded by a large barn, two cowsheds and a stable. All the buildings are substantially built of stone with slate roofs, and in the main are as follows :

Cattle standings	32
Loose-boxes	14
Stabling for	10
Stock-yards	4
Piggery	6 cots

together with a tower silo, granary, five hay barns, a sheep-shed, implement shed and many small buildings. (See Plates 4, 5 and 6.)

The second range of buildings is modern and was erected in the 1930s. It is a self-contained dairy unit based on a sixteen-cow herd, complete with accommodation for calves, young stock, bull, dairy, etc., with an appropriately sized hay barn and other small buildings. Very little use has been made of this range, and since 1939 it has been used by the Cardigan A.E.C. as a machinery depot. (See Plate 7.)

Generally speaking, the farm is well supplied with buildings, but much modification of the main farmstead will be necessary for milk production.

In addition, there are eight cottages on the farm, more or less evenly spread out. These are old and need modernizing.

INBREEDING IN POULTRY

A. W. GREENWOOD

Poultry Research Centre, Edinburgh

The practice of inbreeding is not unknown in the poultry world, and indeed has been employed somewhat extensively in the development of birds for exhibition purposes. The emphasis now laid on the hen as a producer of eggs and meat raises more acutely the problem of the method of breeding to be followed to obtain the most efficient results in the maximum number of birds in a flock. This idea is contrary to the one activating the fancier, for his ultimate objective is to get the outstanding animal—one better than any other individual that might be met in competition in the show ring.

What a difficult and different problem is now posed ! In the first place it is physiological function and not form that is of primary importance, and that is something which cannot be assessed with any degree of accuracy from the outward appearance of a bird. Then again, early discoveries in genetics, which indicated the comparative simplicity of determining the method of transmission of certain external characters from parent to offspring, led to an undue optimism that the behaviour of physiological qualities of economic importance might be as readily exposed by experiment.

Intensified investigation has increased knowledge, but the stage has not yet been reached where a clear definition of the interacting phases of the problem can be given, let alone an adequate solution of them. So geneticists are still using all the techniques of mind and material at their disposal to assist in the search for truth.

There are two schools of thought at the present time, and modern developments in breeding for improvement in production characterize one or other of them. The one builds on the assumption that a physiological quality or any of its components depends for its expression in the individual on a relatively large number of the units of inheritance (or genes) with additive effects. In the second group the theory is held that certain major units may have a readily measurable effect and that the mode of inheritance of qualities dependent on them can be identified and so form the basis for a constructive breeding practice ; where this view is held, inbreeding is a logical approach to the purification of genetic entities that exist in a relatively simple complex.

What is Inbreeding ?

Inbreeding has been defined by Lush as the mating of animals more closely related to each other than the average relationship within the population concerned. The extreme of inbreeding is continued brother-sister mating, but the definition also covers less intense forms.

The uses to which inbreeding may be put are many. It may be hopefully employed by the breeder to retain in his stock the outstanding qualities of individuals ; it may form a tool for the geneticist for specific investigations in inheritance. Before discussing its effect in practice it would be as well, however, to attempt to predict from theoretical considerations just what is likely to happen. Without a knowledge of Mendelism such theories as we have could not have been constructed. Based on the functioning of Mendel's laws of inheritance it would be expected that close inbreeding, if long continued and in the absence of consistent selection, would effectively tend to approach complete homozygosity—that is, the hereditary units contributed by the male and female to the fertilized egg would be identical. A standard bird would be produced, but whether it pleased the breeder or not would depend on the kind of genes the original parental stock possessed, because the theory implies that both good and bad units of inheritance (the latter often hidden in the stock) have equal opportunities of being perpetuated. Since most of the hereditary units producing undesirable effects are recessive and can be seen only in the individual getting them from both parents, it is easy to understand how the generalized statement arose which reads " Inbreeding leads to degeneration of stock ". From actual experience with inbreeding it is not difficult to realize that the poultry population has undesirable qualities disseminated throughout its structure. It is not inbreeding as such that causes this degeneration, but its power of bringing together the genetic units of a hidden character in one and the same individual and so exposing it. If there were no defects in a stock, inbreeding could not produce them ; but as they appear to be inevitably present it is also important to realize that this method of breeding cannot select which are to be eliminated and which retained. With mild inbreeding, however, those properties can prove useful to the breeder for they enable him to select against genetic undesirables which would not otherwise be exposed. More intensive inbreeding is likely to defeat this end by fixing qualities in the stock too quickly to allow selection to act effectively on them.

Having defined inbreeding, a word may be said on the measurement of its intensity : a coefficient of inbreeding has been devised by Sewall Wright which gives a measure of the increase in genetic purity expected to follow from the mating of relatives. It can be applied to the most rigorous system of brother-sister matings, as well as to those between less closely related birds. In its practical application an American standard calls for a coefficient of inbreeding of 50 per cent before a line (family or group) can be referred to as an inbred. This means three generations of brother-sister matings, or more if the parents are more distantly related.

The Importance of Selection

It may assist in appreciating the reasons for differences and apparent inconsistencies in the results of inbreeding if the theoretical considerations involved are elaborated still further.

It has been pointed out that inbreeding is powerless to direct the progress of a flock without the aid of selection, and it is necessary to appreciate why this should be so. Related birds are likely to carry a larger percentage of similar hereditary units in their make-up than those bred at random, and, roughly speaking, the more closely they are related the greater is this common portion of hereditary material. Whether that common inheritance is mainly good or bad depends on two things : the proportion of desirable to undesirable units which the potential parents carry, and the breeder's ability to select the best. This latter, it need hardly be said, cannot be very great, for the reason that the degree to which all productive qualities may be modified by such environmental effects as nutrition and management can so often thoroughly disguise the animals' true breeding worth. If this applies to such measurable characters as body weight and egg number, to give two examples, it is obvious there must be other qualities which contribute to the general well-being of the flock, which even those with an acutely developed " stock sense " would be powerless to identify.

What follows if inbreeding is initiated in a flock of ordinary mixed genetic make-up ? This is most easily illustrated if a system of brother-sister mating is considered.

Each family from a brother-sister mating constitutes a line within which the parents of the next generation must be chosen. But within that family each mated pair will again originate a new line, since the progenies of each different full sub mating within it will now be cousins or half brothers and sisters, according to whether one male was mated to several of his sisters or only one. It follows that if *all* the flock were mated on this system it would rapidly become broken up into innumerable lines, and the hereditary units which were scattered in randomly arranged sets, containing different proportions of homozygous (pure) and heterozygous (impure) pairs in individuals, would tend to segregate out. A few units might be eliminated completely, but in the main the average genetic value of the stock would be the same as at the start, except that the differences would now lie between lines instead of between individuals. Less intense inbreeding systems would lead in the same direction, but at a slower rate.

For the sake of illustration it has been assumed that all the progeny were bred from ; but this would be manifestly absurd in practice, for it is clear that before long such a flock would quickly far outrun the bounds of the largest poultry farm. Nevertheless this brings out a point that usually escapes notice—that is, by merely keeping a flock at a constant level, selection is being exercised even if no conscious thought is given to directing it along particular lines.

In the case of continued inbreeding at any level of intensity, the selection necessary to keep the stock within bounds must inevitably

result in discarding a proportion of the lines which segregate out (in addition to parts of others), and this involves the elimination of hereditary material not present in the remainder. While the breeder is in a better position to identify the quality of measurable characters, it is left to chance whether many of the unrecognizable traits which he eliminates along with the undesirables are good or bad.

In any experimentation with inbred lines it must be realized that physical facilities usually limit the number to a very small proportion of those which could have arisen from the foundation stock. Moreover, difficulties in recognition of what constitutes an efficient group of desirable characters make it impossible to deduce whether the lines retained are really representative of the whole potential group.

Work at Reaseheath and Edinburgh

It is impossible within the scope of a short review to do much more than introduce the subject, and it would perhaps be as well to discuss rather generally experiment and practice where the technique has been employed in poultry with a view to its possible influence on breeding policy.

There are two centres in Great Britain that have been engaged in this type of work—Reaseheath and Edinburgh.

The work at these two centres illustrates effectively what has been generally found where an inbreeding programme has been followed. Incidentally, the original experimental approach at both centres was that engendered by the idea that production qualities were dependent on large effects of a relatively small number of genes. For example, in a recent publication regarding the work at Reaseheath, Pease writes " . . . we at Reaseheath turned in 1933 to an enquiry into the effects of continued brother-sister mating in poultry. It was hoped that this inbreeding would lead to the establishment of a line of standardized poultry . . . ". The disastrous effects that commonly follow such intensive inbreeding soon became apparent. After five years all but one of the original twenty hens were rejected as unfit for further breeding. There was a general loss of vigour and an inability to thrive and breed under ordinary conditions of management. However, one mating proved satisfactory, and it has been possible by continuous brother-sister mating to maintain descendants of this family to the present time.

At Edinburgh the approach to the problem of the genetics of productive qualities was a different one. Beginning with a few foundation birds, particular individuals in the early generations were chosen because they exhibited either contrasting characters, e.g., large egg or small egg size, or showed some quality in the production cycle markedly superior to the general average. These pullets were then mated to close relatives and family groups developed from them in which the criterion of selection was one particular quality only, the genetical analyses of which could play some part in the determination of the inheritance of total annual egg production. The closest form of inbreeding was not practised, but since the experiments have been in progress over a period of almost twenty years without the introduction of outside blood, a considerable amount of inbreeding characterizes the families.

No inbred groups have as yet petered out, but there has been a considerable regression in useful characters not under direct selection. Most of the lines have lost body size (a typical effect following inbreeding) and egg size; in some, mortality from non-specific causes has steadily risen and egg number decreased. Because of the tendency to these types of regression it is not always possible to determine whether the particular qualities that have been selected for are still present in the lines, and so crosses between them are in progress to determine this point.

Before discussing the effect of these experiments, it would be as well to emphasize that not all economic qualities have lost ground by the system of breeding employed. Both high fertility and hatchability of eggs, as well as low mortality, and immunity to tumours, are useful traits which characterize some of the lines, although they have not been consciously selected for.

Much work on plants and animals has been concerned with the production of so-called "hybrid vigour" in crosses between varieties as well as between inbred lines. It is outside the province of the present paper to discuss this important subject in detail; it is sufficient to point out the accepted view that crossing of inbreds gives rise to hybrid vigour through reversing the effects of inbreeding: that is, whereas inbreeding exposes hidden genetic influences, crossing tends to cover them up; by mating individuals with different hereditary make-up it is more likely that undesirable genes will become paired with their desirable homologues and so pass undetected in the offspring. In other words, where the cross-breds receive complementary genes from their parents it is the desirable ones which tend to be expressed, so that the actual performance of the birds may be high, but nevertheless they carry undisclosed weaknesses of the parent lines and are capable of transmitting them.

As indicated earlier, a number of crosses have been made between the lines developed in Edinburgh, and their results provide a sufficiently striking illustration of this theory of the basis of hybrid vigour to merit brief mention here. First crosses between inbred families gave consistently a very low mortality in the pullet year and led to the conclusion that many of the pathological conditions encountered in the flock are heritable. Since there is a tendency for particular types of organ weakness to be associated with certain lines, these results fit in with the idea that the groups involved are donating to the cross complementary genes which overcome each other's defects.

Again, where high egg yield had been selected for in one parental family the average production of the crosses exceeded the average of either contributing line. While it might be that conscious selection for production had led to the accumulation of different sets of useful genes directly affecting egg number, the effects on mortality just cited provide another clue worthy of consideration. If the number of deaths is reduced in crosses it is probable that hereditary sub-lethal weaknesses are similarly suppressed, and the healthier stock which results is better able to express its potential inheritance for production. It is possible that both types of factor are operative, for in a process as fundamental as egg production there must be few bodily functions that do not exert some influence upon it.

This is the crux of the problem where economic qualities are concerned: their units of inheritance cannot be studied apart from the rest of the hereditary constitution of the bird, as can those of simple traits like plumage, colour, and comb shape, and it is this that makes an understanding of the consequences of the breeding techniques we have discussed essential for their investigation.

In conclusion, it may be said that, up to the present, work on inbreeding and cross-breeding has indicated that the most vigorous and productive stock have been derived from the mating of birds of radically different genetic make-up, while the search for animals of standard performance and breeding worth remains an interesting, unsolved problem for the scientist and an important one for the breeder.

MILK PRODUCTION METHOD STUDIES AND THEIR APPLICATION IN INCREASING OUTPUT

J. R. Stubbs

Deputy County Advisory Officer, Gloucestershire

The enormous variation in labour cost per 100 gallons of milk, as revealed by agricultural economists, is particularly interesting when one realizes that a quarter of the production cost is a direct labour cost; and labour, particularly skilled labour, is a very scarce commodity. If we are to have the increased production we aim at, it will be essential to ascertain how it can be achieved by our present labour force. The first question then is: How do those farms with a low labour cost per 100 gallons achieve their objective ?

The first step must be to discover the reasons for these variations; in my view the best way to do this is by the direct approach to the problem, i.e., by method studies unobtrusively conducted on the farm during the normal course of day-to-day routine. Such studies should reveal both the comparative labour efficiency of contrasting " systems " and at the same time the good and bad points within each system. Furthermore, from the evidence it should be possible to decide upon the long-term economic aspect and the advisability of making a change.

Preliminary investigations along these lines were undertaken during the winter of 1945-46, and the evidence was presented to a Farm Buildings Conference at Cheltenham. (The report, *A Milk Production Time Study*, was printed for limited circulation.) Subsequently, it has been possible to recheck these first results, extend the investigation and, more important still, put the findings to a practical test.

In the original survey it was possible to study the comparative labour economy of the milking parlour, the bucket-plant and hand milking, and it was possible also to compare the labour economy of cows kept in traditional cowsheds, cows in yards, and cows lying out all the year round. All herds in the survey were under first-class management; the number of cows milked was approximately 35, with about the same number of followers. The placing of food for convenience of

feeding—a very important factor in any system—had been fairly well thought out in all cases, so that all major complications were eliminated as far as possible. The following table indicates the comparison between six farms :

Comparison of Labour Costs—Milking Only

Farm No.	System of Milking	Average Daily Yield per Cow	Daily Labour Cost on 35-Cow Basis	Labour Cost per Cow*
		gallons	*s. d.*	
5	Hand	1.78	15 7	100
2	4-unit bucket-plant ..	2.4	14 9	95
6	4-unit bucket-plant ..	2.7	12 7	80
4	4-point parlour-plant ..	2.9	12 8	81
1	3-point parlour-plant ..	2.5	12 0	77
3	3-point parlour-plant ..	3.1	10 0	64

* Hand milking cost = 100.

The general comparisons of the labour cost on the 35-cow basis between cattle kept in traditional cowsheds, in yards, and outdoors, are as follows :

	per day	*per cent*
Traditional cowsheds	34s. 0d.	100
Yards	18s. 6d.	55
Outdoors	12s. 6d.	37

The Application

Having obtained this data, the next obvious step was to put the lessons learned to a practical test by selecting farms where the reorganization of method should lead to a general overall improvement in productive efficiency. The story of two such farms illustrates in a striking manner how the good practices from our most successful exponents can be used to marked advantage by others.

FARM NO. 1. This is a very difficult-to-work farm of 162 acres on the Lias clay formation. It is divided by a main road, a railway line and a river, and the dairy was situated across the main road. The two cowsheds were, respectively, 53 and 150 yards from the dairy. The regular labour force was 5, and hand milking was practised. The herd was home-bred. Approximately 120 tons of milk were produced annually, and journeys from cowshed to dairy in carrying this milk totalled 630 miles a year.

Having first of all studied the details under the original milk production time study, the farmer was taken on a tour of farms where he could see various methods and gather various ideas which might be incorporated in a reorganized system on his own farm. Building alterations began as soon as the necessary permits were obtained ; the costs were as follows :

	£	s.	d.
Building	371	11	0
Equipment	408	4	3
Concrete yard	104	11	0
Total cost of change-over	£884	6	3

This sum represents an inclusive charge of £22 2s. 2d. per cow. A letter from the farmer, dated January 27, 1949, contains the following paragraph :

> " It is interesting to note that my milk cheques for the nine months in which the parlour has been used total nearly £500 more than the nine months' total of the previous year. At the same time my wage bill has been reduced by nearly £150. Furthermore, we are doing work on the farm which was never attempted under the old conditions."

Farm No. 2. After a careful study of the facts, this farmer grafted a milking parlour into his existing buildings, the total building cost being £180 (£4 per cow). As a result, he has been able to milk 25 per cent more cows with 33 per cent less labour, and to produce 80 per cent more milk. Any tenant farmer can stand a conversion expense of this kind, which is, in fact, a " top-line " investment. Milk sales on this farm have been as follows :

	Before the Change	After the Change	
	1945–46	1946–47	1947–48
Number of gallons sold ..	15,494	20,985	27,817
Number of cows and heifers ..	36	40	43
Sales average per animal (gallons)	430	524	647

It must be made clear that it is not claimed that the new system is responsible for the increased yield of milk per cow ; in 1945-46 the herd consisted predominantly of heifers and, of course, on the first-rate summer grass available during 1947-48 cows generally yielded very much better than in previous years. The fact remains, however, that one man and a girl can now manage 45 cows producing 80 per cent more milk, and can milk them in less time than was formerly taken by three operators milking 36 cows with the bucket-plant.

Before the change-over the milk had to be carried to the dairy, which was 58 yards from the cowshed, and as this journey had to be made no less than eight times daily the distance covered during the year was over 190 miles. In the new system it is the cow who carries the milk to within 10 yards of the point where the lorry takes delivery.

The Profitable Conversion of Time Saved

Frequently the question is asked : What can one do with the time saved ? A statement of what actually does occur on these reorganized farms will serve to indicate the trend of development.

The first stage is simply a relief of pressure, a reduction in overtime, and a change from continuous rush. The second stage is the making-up of arrears, i.e., work left undone for the past ten years or so, together with more building development (usually carried out by the farm staff). The third stage is the intensification of production.

One hour saved per day represents £36 10s. 0d. per year, which is 5 per cent on a capital investment of £730. This time is saved on chores —i.e., by eliminating useless drudgery—so that more time can be devoted to the detail in stockmanship and cropping which is so necessary for high output. The good manager will work this labour and make

it earn an extra £150 worth of sales. By the abolition of chores and extending the gap between milkings, there will be time on hand to look after (for example) a flock of grass sheep and perhaps a few pigs and poultry, all of which will turn in extra cash sales. This, then, is the answer to the question: What can one do with the time saved?

Looking to the Future

Advice and guidance on reorganization have always followed the same course. First of all, the farmer concerned is presented with detailed facts. Second, he is taken on a tour of various farms so that he can see and judge for himself; and third, his progress is recorded by time study methods. In these days, when so many valuable ideas can be brought to bear upon any particular problem, there is a very grave danger in any suggestion of standardization of methods. For example, the milking parlour system itself, as we know it today, may well be modified very considerably in the near future. Already pioneer and originally-minded producers in Gloucestershire have adopted modified forms of milking parlour technique which appear to hold many marked capital and labour-saving advantages. On one such farm the cows are individually fed in an automatic cowtie before they go into the milking parlour, and one cannot fail to be impressed by the extremely quiet manner in which they go through to be milked, without any upset whatever from the distraction of feeding in the parlour itself. The milk goes direct into a churn which stands on a specially made scale between each pair of cows. There are two indicators on the weighing scale face—one showing the total quantity of milk in the churn and the second the amount of milk given by the last cow. When full, the churns are placed directly in an immersion cooler. This particular cooler is of the chilled-water type; only about two gallons of water are used per week. With this method there are several outstanding advantages:

(1) The cows are fed accurately according to yield.

(2) As no feeding is done in the parlour, there is no need for feeding hoppers.

(3) Whereas in the traditional type of milking parlour the milk goes through a very complicated system of tubes, pipes and containers (all of which must be cleansed and sterilized regularly), in this method the milk goes direct into the churn. Very little dairy work is, therefore, involved. An ordinary bucket-type plant can be used, at less than half the cost of the traditional milking parlour.

There is an enormous field for research in this subject. The discovery of methods proven in practice to be better than others, and their application in various circumstances, must be of immediate and long-term benefit in the present drive for increased production.

ABSTRACTS

ANIMAL BREEDING

Growth and Production of Inbred and Outbred Holstein-Friesian Cattle. Tyler, W. J., Chapman, A. B. and Dickerson, G. E. (Amer. Dairy Sci. Ass.) *J. Dairy Sci.*, **32,** 247-55.

Data were collected from three herds of the Winconsin State Department of Public Welfare on the relative growth and production of inbred and outbred progeny of Holstein-Friesian sires.

The experiment was to compare the progeny of a sire from his own daughters or other near relatives with his progeny from unrelated cows. Any differences which appeared could then be attributed to inbreeding.

The progeny were measured at 6 months, 18 months and at maturity, and the production records of the animals were compared. The numbers of animals in the experimental groups were 60 males and 193 females at 6 months old ; of the females in this group 117 were inbred and 76 outbred. At 18 months of age, of the 152 females, 88 belonged to the inbred group and 64 to the outbred, and at maturity 56 were inbred and 55 outbred cows. From analysis of the measurements taken there was no difference between the measurements of the inbred and outbred groups as a whole, except for heart girth, which showed a slight reduction in the inbred group, and this was significant only in the 18-months-old cattle.

Measurements of production, however, were different, and the results showed that inbreeding had a depressing effect on both milk and butterfat production. This reduction was in direct proportion to the degree of inbreeding, corresponding to a decrease on sire-daughter mating of 183 gallons of milk and 57 lb. of butter fat. No evidence of an effect of inbreeding on butterfat percentages was indicated.

There was considerable difference between the sire groups, indicating that the offspring of some sires could be inbred without any apparent decrease in body size or production. This may have been the result of the increase in relationship to a superior transmitting sire whose daughters, because of their inheritance of high production, more than offset any detrimental effect of inbreeding.

The Movement of Two Breeds of Pedigree Dairy Cattle in Great Britain. Robertson, A. and Asker, A. A. *Emp. J. exp. Agric.*, **17,** 125-31.

There is a considerable regional variation in the annual milk yields per cow in the various parts of Great Britain. Very roughly, the centre of the high yield and low butterfat percentage is in the South-East, with a decrease in milk yield and an increase in fat percentage westwards and, to a small extent, northwards. This general picture was arrived at after a study, by the writers, of the National Milk Records herd averages for Friesians and Shorthorns in the various Milk Marketing Board Regions.

This paper is an attempt to discover if a difference in breeding is likely to be an attributable factor. If few animals were moved either to or from a given area and herds were confined to their own particular environmental conditions, then genetic breed differences could be set up between areas. For this analysis the writers divided the country into areas, England constituting nine, Scotland and Holland one each. A hundred females from each area were chosen at random from the last available herd books of the Shorthorn and Friesian breeds, their pedigrees were traced back for two generations and the birth places of their ancestors were noted.

The amount of migration from one area to another was found, and, as might be expected, it was greater amongst males than females. The results suggest that there is very little genetic isolation within pedigree herds. The Shorthorns in north-west England are perhaps an exception, since very few cattle are taken into that district as replacements, and, since many bulls are moved from there to other parts of the country, the influence of that area is widely felt.

The amount of movement amongst animals of the Friesian and Shorthorn breeds is so large as to preclude the possibility of much of the differences in milk yield and butter fat being due to heredity. The Shorthorns in north-west England and Friesians in Essex are, perhaps, exceptions.

These findings suggest that the greater part of the geographical variation is due to differences in climate, soil, feeding or management.

W. L.

SOILS

Some Aspects of Green Manuring. *Soils and Fertilisers*, **12,** 3 (1949), 155-9.

As a supplement to animal manures, green manuring has been known since the earliest times but is of variable value, depending on soil, climate and crop. The process requires adequate moisture and is of little use if the rainfall is less than 20 inches per annum.

The benefits are believed to be due to increased nitrogen and humus content, improved texture and moisture-holding capacity. In the tropics, it is not regarded as a fertility store but as a quick-acting manure, which is exhausted in less than two crops. The belief that humus is essential originated when it was thought that fertility depended solely on manures of organic origin.

The more modern view is that fertility is dependent on improvement of physical condition as well as the amount of plant food supplied. Cultivations give a suitable physical condition, but these disappear at the first rain if certain salts are not present. Decomposed green manure supplies the requisite salts, which are easily leached, and is effective only on poor soils of unstable physical condition.

Humus should be conserved by rotations including perennial crops, since cultivating tends to decrease the humus content of the soil. Long leys build up the humus content and are sounder than attempts to use added organic matter. It is undesirable for organic matter to accumulate, and the crop should be buried while still green and succulent.

The critical C : N ratio of green manure is approximately 35 : 1 ; if less, some nitrogen is available to the plant but otherwise the micro-organisms responsible for decomposition absorb all the nitrogen and yields suffer.

The improved physical condition produced by deep-rooted plants is due to the roots opening the soil. Legumes are more effective than cereals, as they have a greater proportion of root at great depths. The decomposing material helps the formation of the desirable water stable " crumb " structure, but the structure of true sandy soils is not affected.

The increased yields have been ascribed to increased activity of the micro-flora (obtained from the decomposition) affecting the nutrient balance of the soil ; the CO_2 produced reacts with the minerals to increase the availability, particularly of phosphate ; the more common crops grown for green manure (lupins, mustard, etc.) extract more phosphate than other plants, and it then becomes available. Potash is also made available, an extreme increase of 200 per cent having been reported ; the increase is associated with the potash content of the added material.

On decomposition, both the total and organic phosphorus increase at first, but subsequently, because of the activity by micro-organisms, the organic phosphorus decreases. This phosphorus is released steadily and provides a steady supply of available phosphorus which would be " fixed " if liberated immediately.

T. G. H.
W. M. D.

Earthworms and Soil Fertility. Froud, M. D. *Agric. Progr.*, **23** (1948) 54-8.

A résumé of speculation, thought and work in connection with the influence of earthworms on soil fertility from the middle eighteenth century to the present time is given. Difficulty was experienced in establishing a clear answer, but certain important facts have emerged.

Earthworms live on plant remains, returning plant nutrients and organic matter mixed with a large amount of ingested soil to the land in their faeces in the form of casts. These casts can be produced above or below ground level according to the species of the worm and are much richer in organic matter than the original soil. The population of earthworms is greatest in soils containing the largest amounts of organic matter, grassland and forest areas, but only when the soil reaction is approximately neutral. Up to 12 cwt. worms per acre can exist in old pasture against ½ to 1 cwt. in arable land. When occurring in large numbers they play an effective part in improving the physical condition of the soil, producing a layer of fine soil and humus at the surface and depositing calcium carbonate, derived from plant material after secretion through the califerous glands.

Under artificial conditions of arable farming, earthworms probably have little influence in the soil. Modern cultivations and management

bring about the same physical effect which earthworms have on uncultivated soils. Moreover, additions of fertilizers, whether organic or mineral, to make up the plant nutrients counterbalance those derived from plant residues or animal excrement.

J. W. B.
W. M. D.

HERBAGE

The Ash-content of some Grasses and Herbs on the Palace Leas Hay Plots at Cockle Park. Thomas, Brynmor and Thompson, A. *Emp. J. exp. Agric.*, **16** (1948), 221-30.

The herbs examined were *Plantago lanceolata* (ribgrass), *Ranunculus* sp. (buttercup), *Rumex acetosella* (sheep's-sorrel), and *Rhinanthus crista-galli* (yellow rattle), and the grasses *Cynosurus cristatus* (crested dogstail), *Holcus lanatus* (Yorkshire fog), and *Festuca rubra* sp. (red fescue); the material was collected some three weeks before mowing for hay.

Ribgrass was found to be a good source of calcium, and contained useful amounts of phosphorus and more sodium than any other plant. It was highly efficient with regard to minor elements, particularly cobalt and copper, but poor in manganese.

Buttercup was useful as a source of calcium and phosphorus, notably poor in manganese and sodium, but rich in cobalt and copper.

Sheep's-sorrel proved to contain a large amount of iron and a high content of potassium, but otherwise was not a herb of outstanding mineral efficiency.

Yellow rattle was the most highly mineral-efficient herb examined, containing outstandingly high proportions of calcium and phosphorus. It was a remarkably good source of copper, manganese, sodium and magnesium (cobalt not estimated).

The grasses examined were by comparison less mineral-efficient than the herb species. Yorkshire fog contained useful amounts of the most important ash constituents, but was low in magnesium and cobalt. Crested dogstail was poor in major and minor elements except phosphorus, which was present in moderate amounts. Red fescue was an extremely poor source of minerals apart from iron and manganese. When this species is the major component of a sward the herbage might be incapable of meeting the normal mineral requirements of farm animals.

The effect of the manurial treatments, which have been applied continuously for fifty years, on the ash-content of the above species is also reported. Farmyard manure was efficient in increasing the potassium content, but there was no evidence to show that farmyard manure supplied lavish amounts of trace elements to the crop. Sulphate of ammonia increased the phosphorus content; basic slag had a beneficial influence on the phosphorus and calcium content of the species examined.

but depressed the trace element content. Potash manuring increased the potassium content. It was considered that manurial practices cannot have much influence in increasing the all-round efficiency in the trace element content of sward constituents. The only practicable way of doing this is deliberately to encourage individual species known to be mineral-efficient.

Silage in Canada. Riply, R. O. *Emp. J. exp. Agric.*, **16,** 64 (1948) 237-40.

In Canada, maize is the most important silage crop. Its high carbohydrate content renders it particularly suitable for ensiling without the addition of any preservative.

By comparison, other crops such as lucerne and grass-clover mixtures are more difficult to use because it is not easy to control fermentation, but good results have followed the use of molasses and acids. It is considered that the introduction of forage crop harvesters has had, and will continue to have, an influence on silage-making, particularly on the larger farms. It will be possible to handle heavy, bulky crops without heavy manual labour.

T. E. W.

FRUIT

Growth Substances

Although the existence of a specific root-forming substance in plants was first postulated in 1880 by Sachs, the progress of research on plant hormones or " growth substances " was slow until about twenty years ago, when many synthetically prepared chemicals were found to possess similar properties to the naturally occurring hormones. Workers were quick to realize the possibilities of controlling plant growth and development in commercial horticulture by means of these substances, and already a vast amount of research on these lines has been done. A summary of existing knowledge on the practical use of growth substances in horticulture has been assembled by Dr. H. L. Pearse [1], who lists over 1,500 individual publications. The chief points of interest to fruit-growers are selected below.

Vegetative Propagation

Care in the selection and subsequent handling of hardwood cuttings is of great importance, and the growth substance cannot replace this care. The growth substance used must not have lost its potency during storage ; materials should be roughly checked from time to time on plants, e.g., tomatoes, known to react.

Many methods have been used for applying growth substances to cuttings. The lanoline paste method widely used in early work is now obsolete. The dilute solution method is simple to operate and is often

successful when other methods fail, but there are difficulties in standardizing the amount of solution absorbed, since this depends on temperature, humidity, degree of crowding of cuttings in solution, etc. In practice, a period of twenty-four hours for treatment, using the highest non-toxic concentration, seems best. Quicker working can be obtained by using the growth substance in talc or powdered charcoal, or in concentrated solution in 50 per cent alcohol into which the cuttings are dipped. The latter method is especially quick and very uniform treatment can be obtained, but it is wasteful of material and only enough for each day's work should be prepared. Other ways of applying the materials, such as spraying the parent plants, watering and spraying cutting beds, have not been very promising, but dipping in a clay puddle containing the growth substance has proved successful for suckers of *Pershore Yellow Egg*. In some cases, repeated treatment with growth substance may help ; in others, delaying the treatment until after callus has formed on the cutting may be best.

While indolylbutyric acid is generally considered the best material for encouraging rooting, mixtures of several substances are often more effective than individual substances ; there is, therefore, a hope of one day producing a general-purpose mixture for a range of plants.

This section of the review concludes with practical recommendations for the treatment of cuttings and a selected list of plants, extending over 80 pages, with the results obtained by various workers, thus serving as a guide to the approximate concentrations to use.

Treatment of Growing Plant

While growth substances applied as solutions to the soil can greatly affect the behaviour of plants, there appears to be no practical advantage to be gained. Their use in transplanting is also of doubtful value, though in the case of pecan trees, notoriously slow to become established after transplanting, the insertion of tooth-picks, each containing 2 mg. indolylbutyric acid, in four holes around the tap root resulted in quicker establishment and growth.

The nutrition of the plant can affect the normal production of hormone, and there is some evidence that a growth substance may be able to replace an essential mineral element, thus suggesting that the element is involved in the natural formation of the hormone. It has been found that many soils and organic manures contain indolylacetic acid, and attempts have been made to link this up with the effects of these soils and manures ; so far, however, without any useful result.

The Production of Parthenocarpic Fruit

The results achieved with tomatoes are well known, but, although beneficial effects have been obtained with strawberry (*Tardive de Leopold*) using α-naphthalene acetic acid and β-naphthoxyacetic acid, and blackberry, using 4-chlorophenoxyacetic acid and β-naphthoxyacetic acid, results with the chief fruits have on the whole been unsuccessful. The fruitfulness of some fruit trees (including cherries) seems to be linked with the presence of a high content of hormone in the buds ; this is obviously an interesting line with practical applications.

Selective Weed-killers

As a guide, tables are given of plants killed by or resistant to 2-4 dichlorophenoxyacetic acid and 4-chloro-2-methylphenoxyacetic acid or their salts. So far they have been little used amongst fruit, and it is not known whether they can be safely used. With strawberries, 2-4 dichlorophenoxyacetic acid at 1,000 p.p.m. is known to damage blossoms and fruits, and so could be used only on newly-planted plantations. Persistence of the chemical in the soil depends on temperature and is shortest in warm moist soils, where it is a matter of only a few weeks. There is great danger from the use of spray equipment contaminated by these selective weed-killers, and washing out with washing soda solution is advisable. It is known that 2-4 dichlorophenoxyacetic acid can injure apple trees and malform the fruit of certain varieties when used in summer oil sprays, or even when it occurs as contamination in sprays or as drift from spraying weeds.

Bud Inhibition

The influence of an actively growing terminal bud in suppressing the development of lateral buds lower down on the same shoot has been shown to be the result of hormone activity ; indolylacetic acid has been found to have the same sort of action. Many workers have used growth substances in attempts to delay the opening of buds of deciduous fruit trees so as to escape frost injury ; spray solutions applied just before bud-break have given very variable results, and the risk of injury has proved to be too great for practical use. Bud-break of fruit has, however, been delayed from a few days to as much as fourteen days by potassium α-naphthaleneacetate applied during the preceding July, August and September in the U.S.A. If, however, the concentration of growth substance is too high or application is too early, the killing of twigs and damage to fruit- and leaf-buds may result. So far, methods for large-scale use have not been worked out.

Various Other Uses

Attempts have been made to increase fruit-bud formation by applications of a growth substance but without useful results. Another field of research is the acceleration of healing of graft and other wounds ; some beneficial results have been obtained on apple grafts but not on cherry or pear—in fact in some cases excessive callus growth pushed scion and stock apart. The treatment of scions of English walnut and some other nuts when grafting on seeding roots caused roots to grow from the base of the scion as well as from the stock.

The effects of growth substances in preventing abscission, as with pre-harvest drop of apples, are well known [2]. The leaf drop of apples frequently caused by 1 per cent summer oil has also been prevented by incorporating 10 p.p.m. α-naphthalene acetic acid in the spray.

The treatment of fruit in store is another field of investigation yielding valuable results. Thus low concentrations of growth substance have

been found slightly to increase respiration of pears, and high concentrations slightly to reduce it. High concentrations of some substances definitely hastened ripening of certain apples and pears, but the practical uses of such treatments have yet to be worked out. Reduction in amounts of scald have been obtained under certain conditions.

In attempts to improve fruit-set, it was found that α-naphthalene acetic acid actually reduced fruit-set, and this led to the use of growth substance for blossom thinning. Results have shown great varietal and seasonal differences, and such treatments cannot yet be recommended.

H. B. S. M.

References

1. *Technical Communication No. 20, Commonwealth Bureau of Horticulture and Plantation Crops* (1948).
2. M. C. VYVYAN. Fruit Fall and its Control by Synthetic Growth Substances. *Technical Communication No.* 18, *Commonwealth Bureau of Horticulture and Plantation Crops* (1946).

FLOWERS

Notes on Growth Habits and Pinching of Hydrangeas. Dunham, C. W. and Roberts, R. H. *Proc. Amer. Soc. hort. Sci.*, **52** (1948), 525-7.

In these studies it is shown that the size of the flower head is closely correlated with the diameter of the shoot bearing it. One millimeter of stem diameter was found to be equivalent to approximately one inch of blossom diameter. The diameter of the flowering shoot in turn depends upon the size of the subtending leaf, the correlation again being very close. The production of large flower heads therefore depends upon obtaining a break from a large leaf.

The normal habit of growth is such that when a dormant shoot or a new break begins to grow, the first pair of leaves is small in comparison with succeeding pairs. For the first stopping it is necessary, therefore, to pinch back to a node which bears large leaves. In making the second stopping the phyllotaxy (leaf-arrangement) was found to be of prime importance. The first and third pair of leaves on the breaks from the first stop are not in the same plane as the crotch formed on the original stem, while the second pair has one leaf in line with the crotch. It was found that the break produced from a bud in line with the crotch is much weaker than the one opposite and may fail altogether. The second stop should therefore be to a pair of buds out of line with the crotch. This is an interesting example of a knowledge of botanical morphology applied to horticultural production.

The Incidence of Blindness in the *Better Times* Rose. Kamp, J. R. *Proc. Amer. Soc. hort. Sci.*, **52** (1948), 490-500.

Growers of glasshouse roses suffer serious losses from the production of " blind shoots," i.e., shoots not terminating in a flower. Earlier workers have shown that flower bud initiation begins in all shoots, but that not all of these flower buds reach maturity, early abortion and ab-

scission of many of them giving rise to blindness. From the fact that blindness is often more prevalent in winter, growers often attribute the trouble to poor light. In this work roses of the variety *Better Times* were subjected to shading and to varying degrees of defoliation and studies made of the incidence of blindness, the number of flowers and the chemical composition of the plants. It was shown that blind shoots bear less than half the number of leaves borne by flowering shoots. It was found, however, that shading had no effect on the number of leaves borne on blind or flowering shoots, on the total number of shoots, or on the number of blind shoots. Defoliation, on the other hand, increased the total number of shoots and also the percentage of blind shoots. Chemical composition of the plants, and in particular the carbohydrate-nitrogen status, had no relation to the incidence of blindness. It is concluded that blindness depends upon a hormonal mechanism, not directly related to light intensity.

Forcing Tulips with Artificial light. Van der Veen, R. *Philips Tech. Rev.*, **10** (1949), 282-5.

Earlier experiments by Roodenburg and his collaborators at the Philips Laboratories at Eindhoven on the forcing of bulbs with artificial light gave such promising results that van Geel carried out trials with the method on a larger scale. A gladiolus drying shed was thermally insulated on all sides with a one-inch thickness of wood-fibre sheet. The temperature was kept constant at 22°C. (71.5°F.) and the whole shed was fitted up with electric light with 75-watt bulbs mounted about 30 inches apart and the same height above the bulb boxes. This installation represents about 9 watts per square foot of illuminated area. The lamps were switched on for 9 hours per day, and to get the maximum illumination the shed was internally whitewashed.

Tulip *Krelage's Triumph* was placed in the shed on December 18, and began flowering 17 days later. Similar bulbs were forced by normal methods in a glasshouse. The growth and flowering in the shed were much superior, with longer and stronger stems and a much smaller proportion of " stragglers ". *Bartigon* similarly forced on January 16 again gave results superior to those in the glasshouse. Trials with fluorescent lights gave good results also, but growth was not quite so rapid as with the incandescent lamps, possibly owing to the lower amount of infra-red radiation.

It was found also that the cost of production was lower owing to the lower fuel consumption, though comparative figures are not quoted. Many growers in the Netherlands have already started converting their drying-sheds for the forcing of tulips by artificial light.

R.H.S.

Magnesium Deficiency in Horticulture

During the last few years the incidence of magnesium deficiency has increased considerably, owing partly to its being more widely recognized by chemical and diagnostic means and partly to the accumulative use of NPK fertilizers in the absence of any magnesium salts or magnesium limestone. This deficiency occurs in a wide range of annual and perennial crops, including glasshouse tomatoes, vegetables, soft and top fruit. Soils where the exchangeable MgO is low are rare, and the reasons for its unavailability have to be sought elsewhere. Attempts to correct the deficiency by soil applications of magnesium sulphate or magnesium limestone have not been entirely satisfactory, especially in regard to the time factor. On the other hand, the successful responses found from the use of magnesium sprays to the foliage are displacing, if not supplementing, soil curative methods. The following papers indicate the trends in this problem.

Magnesium Chlorosis of Tomatoes. Hunter, J. G. *Nature*, **158** (1946).

In sand culture experiments, high concentrations of nutrient salts, especially with a high potassium-magnesium ratio, induced a chlorosis attributed to insufficient uptake of magnesium. In glasshouse trials a similar induced chlorosis was associated particularly with the use of potassium sulphate, although other potassic fertilizers caused the same results. Heavy applications of magnesium sulphate to the soil at different centres in south-west Scotland failed to effect a cure of this chlorosis, even over a period of several years. Effective treatments consisted either of spraying the foliage with magnesium sulphate or carrying out early mulching with farmyard manure or peat in order to encourage secondary root production. It is suggested that the reason why this induced deficiency cannot be corrected by soil applications is because the application of magnesium salts merely increases the salt concentration of the soil solution preventing the absorption of magnesium.

Experiments on correcting Magnesium Deficiency in Glasshouse Tomatoes. Nicholas, D. J. D. *J. Pomol.* and *Hort. Sci.*, **24,** 1 (1948).

Experiments at four centres in the West Country are described for the years 1943-46. Corrective methods tried consisted of solid applications of calcined kierserite (anhydrous magnesium sulphate), foliage sprays with magnesium sulphate, and the application of magnesium sulphate in solution to the roots.

The most effective treatment was a 2 per cent spray, using in all 5 cwt. per acre throughout the season, applied five times to the foliage at intervals of three weeks. The first spray was put on during May. Varying rates of kierserite (20 per cent MgO) were applied to the soil

Experimental Husbandry Farms: 1. Trawscoed

1. Arable and the main farmstead on the lowland, with the Ystwyth Valley in the distance.
2. The lowland, looking south-east. The Mansion is in the wooded background.
3. Intermediate area, with the lower reaches of the hill on the left.

4. Loose-boxes at the main farm buildings, with tower silo in the background.

5. One of the stock-yards.

6. Piggery of six cots.

7. Modern dairy unit in the range near the Mansion.

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9 127
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and a minimum of 10 cwt. per acre was found necessary to correct the shortage of magnesium in the plant ; in severe cases rates up to 20 cwt. per acre were found to be more satisfactory. Applications of solutions of magnesium sulphate to the roots in amounts equal to foliage sprays were ineffective.

It was found that the incidence of magnesium deficiency is reduced by soil application of kierserite with or without potash, although the magnesium content of the leaf is higher when potash is omitted. However, the omission of potash fertilizers did not cure the deficiency. The experiments show the value of using visual and chemical methods, as complementary diagnostic techniques. Estimates of the magnesium content of the mid-stem leaves showed that when the magnesium level fell below 0.50 per cent the first symptoms of the deficiency could be expected.

Variations in Magnesium and Potassium Contents of Individual Leaves from Mineral-deficient Apple Shoots. Kidson, Elsa B. *J. Pomol.* and *Hort. Sci.*, **23,** 3 and 4 (1947).

The sampling of leaves for chemical analyses from apple trees (var : *Jonathan* and *Sturmer Pippin*) suffering from magnesium and potash deficiencies requires to be accurately carried out, because the magnesium and potash contents of the leaf vary according to its position on the leaves and the nutritional status of the tree.

Scorch caused by magnesium deficiency was present on leaves ranging from 0.05 to 0.16 per cent MgO. On a leader showing magnesium deficiency the range between the lowest and highest leaf was tenfold (0.09-0.96 per cent MgO). Scorch caused by potassium deficiency was present on leaves ranging from 0.25-0.80 per cent K_2O. When certain nutritional conditions occur, the difference between the lowest and highest leaf is not marked, and the potash leaf status of a healthy leader ranged (2nd-26th leaf) from 1.60-1.80 per cent K_2O. However, on a magnesium-deficient leader the potash status falls from 2.5 per cent in the oldest leaf to 0.70 per cent in the youngest.

The data indicate that for the study and diagnosis of magnesium and potash deficiencies it is always desirable to take samples of leaves from a definite part of the leader shoot, avoiding the top leaves.

Note on the Control of Magnesium Deficiency of Apples. Wallace, T. *Long Ashton Res. Sta. Ann. Rept.* (1947), 58-61.

Experiments, begun in 1939 at different centres on the practical cure of magnesium deficiency in apple orchards, are described. The remedial methods tried consisted of soil dressings of magnesium sulphate, using calcined kierserite at 4-5 cwt. per acre and magnesium limestone at the rate of 2 tons per acre. Annual dressings of magnesium sulphate applied annually for a period of 3-4 years gave successful results, but the cure was slow. Magnesium limestone was ineffective and is not recommended. Magnesium sprays were used at experimental centres during 1945-47, and it was found that a 2 per cent solution of agricultural Epsom salts, plus a spreader and four to six fortnightly sprays beginning at petal fall almost eliminated the symptoms of the deficiency in one season. W. P.

Storage Studies

During the recent war the importance of the potato as a reserve in our food supplies gave some impetus to investigations of the storage of tubers. Part of the results of an investigation on clamp storage at Rothamsted by Crook and Watson (*J. Agric. Sci.*, **38** (1948), 440-57) has now been published. It gives a detailed account of changes from October to July in reducing sugars, sucrose, nitrogen (three fractions), residual dry matter, fresh weight and dry weight. Up to May there was very little change in composition or cooking (boiling) quality. The chief danger in this period was production of too much reducing sugars from starch when temperatures in the clamp fell below 6°C., since too high a concentration of reducing sugars makes potatoes unsuitable for manufacture of crisps. The loss of fresh weight up to the end of April by normal physiological processes (transpiration, respiration and sprouting) was negligible compared with the potential loss through infection. Removal of the soil cover in April caused increased loss of water without reducing loss of dry weight or loss by rotting, and is therefore to be discouraged as a routine procedure. There were no variations in behaviour of practical significance which could be ascribed to variation in position within the clamps, which were of commercial design, but the authors suggest that work is still needed on clamp design.

When cotton seed of more than 12 per cent moisture content is stored in certain parts of the U.S.A. there is a deterioration in the quality of the oil, production of free, fatty acids, and loss of germination capacity. It has been shown that propylene glycol diproprionate (PGDP) and 4,6-bis-chloromethyl xylene (DCB) are effective in minimizing changes in oil quality. Lambou, King and Condon (*Science*, **108** (1948), 563-4) investigated the utility of these substances in preserving germination capacity. Cotton seed with 8.9 per cent moisture and a germination figure of 92 per cent was conditioned to 12 per cent moisture. One-third was kept as control, one-third treated with 0.28 per cent of its dry weight of a mixture of one DCB to eight PGDP, and the remainder with 0.14 per cent of the same mixture. After six-and-a-half months' storage the germination figures of the three lots were 33, 47 and 67 per cent respectively. The roots and hypocotyls of seedlings from the treated lots were consistently bigger than those of the control. The final moisture contents of the three lots were 11.6, 9.8 and 9.6 per cent, and their contents of free, fatty acid were 6.25, 1.48 and 1.03 per cent. There appears, therefore, to be some hope of a chemical treatment which will prevent loss of germination when seeds have to be stored above their critical moisture content.

Varietal Problems

An authoritative comparison of *Kenia* barley with our standard malting barleys, *Spratt Archer* and *Plumage Archer*, is given by Hunter (*Farming*, **3** (1949), 86-8). In trials at the National Institute of Agricultural Botany, *Kenia* yielded slightly less than *Spratt Archer*; it has a thousand grain weight 3.6 gm. lower and a nitrogen content 0.12 per cent higher; it yields 1.4 lb. less brewers' extract per quarter. The

advantages of *Kenia* are earlier ripening, allowing a spreading of harvesting, and a stiffer straw, allowing heavier manuring. In proportion as quality becomes more important, so these advantages tend to be outweighed by the disadvantages. The position of the new Scandinavian varieties related in one way or another to *Kenia* (*Balder*, *Ymer*, *Freja*, *Rigel* and *Weibull's* 4744) is yet to be determined.

Ekelund (*Züchter*, **19** (1948), 118-9) has devised a new method of variety determination for potato tubers. The method is based on the principle that the mixture of amino acids produced by relatively mild hydrolysis of expressed juice is characteristic of the variety and, if titrated electrometrically in the presence of formaldehyde, gives a characteristic titration curve. The author's results show that the form of the curve is not seriously affected by the type of soil on which the crop is raised.

Hormone Weed-killers

It has been shown that activated charcoal will protect plants from the effects of 2,4-D weed-killers, apparently because it strongly absorbs the weed-killer. Weaver (*Bot. Gaz.*, **110** (1948), 300-12) has described garden plot experiments, mainly with kidney beans, soya beans and peas, designed to investigate this effect in the field. It was found that activated charcoal raked into the top layer of soil at 500 lb. or more per acre would " detoxify " plots which had been treated with as much as 10 lb. per acre of ammonium 2,4-D. A cone of charcoal mixed with soil placed above the individual seeds partially protected them from 2,4-D subsequently applied at the soil surface. Dusting the aerial parts of plants with activated charcoal or thoroughly wetting them with a 5 per cent aqueous suspension gave protection against subsequent spraying with 2,4-D products. J.L.F.

DAIRY BACTERIOLOGY

Water Examination

Those whose duty it is to take water samples for bacteriological examination receive specific instructions for their care and transport. That these instructions are not lightly given is emphasized by the results of the work of C. B. Taylor and V. G. Collins (*J. Gen. Microbiol.*, **3**, 1 (1949), 32), who studied the growth of bacteria in waters stored in glass containers. Growth was found to occur in the water itself and on the surfaces of the container, and was in some cases many times greater than that in the water under natural conditions.

The factors affecting the growth of bacteria were studied in detail, but the importance of temperature in encouraging or restraining growth was emphasized.

Str. cremoris for Starters

Strains of *Str. cremoris*, to be suitable for use as starters in cheese-making, must be able to grow at 37°C. or even higher without significant impairment of metabolic properties. H. R. Whitehead and G. J. E. Hunter (*J. Gen. Microbiol.*, **3**, 1 (1949), 43) have shown that strains which

have these properties show, after incubation at 37°C., for strains in milk culture, certain characteristic morphological forms (not shown under the same conditions by *Str. lactis*) which permit their selection, with the probability that they will be types which can be used as cheese starters. The number of suitable strains seems to be very restricted.

Penicillin and the Lactic Streptococci

G. J. E. Hunter (*J. Dairy Res.*, **16,** 1 (1949), 378) found that ten strains of *Str. cremoris* were inhibited by low concentrations of penicillin such as might be found in bulk milk for cheesemaking after giving penicillin treatment to those cows with mastitis.

Pasteurization of milk containing penicillin had little effect upon the activity. The circumstances, in practice, under which residual penicillin might affect the cheesemaking process are discussed by the author.

Hypochlorites and Corrosion

Hypochlorites are now widely used in this country as sterilizing agents for milk plant and equipment, but it is well known that under some conditions they may be corrosive. C. H. Botham and G. A. Dummet (*J. Dairy Res.*, **16,** 1 (1949), 23) have investigated the phenomena involved and their inhibition. They found that when sodium silicate is added, inhibition of corrosion is specific and not due merely to increased alkalinity, since NaOH and Na_2CO_3, when added to bring the *p*H to the same figure, are not so effective.

Commercial hypochlorites at 150 p.p.m. Av. Cl. and at 40°C. attack aluminium, tinned copper, nickel-silver and cast stainless steel. Hypochlorites containing $KMnO_4$, when aged, are potentially dangerous to wrought stainless steel.

Coliform Organisms in the Udder

A. Cunningham and D. H. McLeod (*Proc. Soc. App. Bact.* (1948), 20) found persistent coliform infection of very low count milk. Careful examination of composite foremilk samples revealed that one cow was infected in one quarter with coliform organisms. There were no symptoms but the infection persisted from one lactation to another.

The organism was found to be typical faecal *Bact. coli*. The infection lasted for at least a year and was therefore established in the udder. Three animals in the same herd became infected and it seems that the organism could colonize the udder of a number of cows without producing symptoms.

[The abstractor has encountered similar infections with *Bact. coli* and *Bact. aerogenes*, and the observations are obviously of practical importance.]

Mastitis and Penicillin

J. K. L. Pearson (*Proc. Soc. App. Bact.* (1948), 27) has observed widespread infection of cows' udders with *Staph. pyogenes*, which are claimed to be resistant to penicillin. This condition might have followed treatment with small doses, or the indiscriminate use, of penicillin. The author claims that following treatment for streptococcal infections the number of staphylococcal infections increased, and he puts in a plea for the control of the treatment of udder infections with penicillin.

W. A. Hoy and A. Rowlands (*Proc. Soc. App. Bact.* (1948), 40) report some interesting trials with a wet storage method of sterilizing milking machine clusters. They developed a standard rinse technique for assessing the bacteriological state of clusters and milk tubes and suggest that plate counts of about 50,000 per cluster are easy to attain in practice and that counts in excess of 1 million per cluster indicated bad work.

They found that clusters may be kept in good condition by storage in 1 or 2 per cent solutions of a detergent containing 65 per cent Na_2CO_3 +35 per cent $Na_2SiO_35H_2O$ with or without the addition of 100 p.p.m. available chlorine, provided that the rubbers are in good condition. Even with tubes in poor condition the results were better than those obtained with other farm methods which did not include good heat treatment. It seems that the method of wet storage in solutions not affecting aluminium might be investigated, with advantage, in the field.

A.T.R.M.

DAIRY HUSBANDRY

Type and Production

The perennial controversy regarding the value of judging dairy cows on their conformation continues. On the one hand there have been frequent pronouncements, often unaccompanied by evidence, indicating that no definite relationship exists between form and function. (*Farming*, **2** (Oct., 1948) ; *Farmer and Stockbr.*, 10.2.48). On the other hand, most of the recent documentary evidence seems to point to a reciprocal correlation between conformation and yield of milk or butter-fat.

Buchanan Smith, in his recent paper on Inheritance of Milking Capacity in Dairy Cattle (*J. Farmers' Club*, **7** (1948)), stated that he could not agree with the view that conformation can be left to look after itself. He supported the showing and judging of dairy animals provided the milk records are also taken into consideration. In the 1948 Report of the New Zealand Dairy Board (*24th Ann. Rep.*) there is a chapter on breed type and production records in Jersey cattle. In tables dealing with various aspects of the problem, evidence of a definite association between type and production is presented.

It is also shown that within any class of the cow's population the type ratings and milk records are widely distributed, and that there is a considerable amount of overlapping between the various classes. Thus, a cow with good conformation may have a poor milk record and *vice versa*, but this does not prejudice the validity of the general correlation. In no circumstances should classification of type displace the testing for production. Both are pre-requisites of dairy husbandry. Studies by Tyler and Hyatt in the United States (*J. Dairy Sci.*, **31** (1948), 63-70) and Hyatt and Tyler (*J. Dairy Sci.*, **31** (1948), 71-9) have established that a statistically highly significant relationship exists between the type classification rating and first butter-fat record of a cow. To improve the assessment of type the authors recommended several type ratings on an individual cow. Cook and Sveang (*Hoard's Dairyman*, **93** (1948), 24) consider that in evaluating a dairy cow consideration of type, pedigree and production should be combined ;

to indicate that the actual production record of the cow is of utmost importance, they suggested that it be given 40 per cent of the marks as against 30 per cent each for type and pedigree.

One thing stands out in all current discussions on type and production. The so-called " fancy points " have no longer a place in an intelligent approach to the problem.

The Use of Identical Twins in Husbandry Experiments

Apart from their use in breeding investigations, identical twin cattle seem likely to be extensively used in future in many other research fields for which growing or milking dairy stock are required. Research workers using milking cows in the past have always been hampered by the big cow-to-cow and day-to-day variation in yield, which often made it necessary to use large numbers of cows in order to obtain significant differences between treatments. Owing to the inherent similarity in growth rate, behaviour and milk production in monozygous twins, much smaller numbers will give statistically significant results. The first real attempts at collection were made by Kronocher (*Deutsch Landwirtsch. Tierzucht*, **34** (1930), 851-74), though it was left to Bonnier in Sweden (*Heredity*, **2** (1948), 1-27) to make a large collection and to show their value as experimental animals. More recently, collections have been started in New Zealand, Norway, Denmark, Great Britain and the U.S.A.

From the results of experiments, Bonnier *et al.* (*K. Lantbruksakad. tidskr.*, **85** (1946), 455-67) have estimated that " twin experiments are at least twenty times as efficient as ordinary group experiments in the case of . . . growth rate in heifers. . . . In the case of milk yield . . . the twin experiments . . . are at least five times as efficient." Following a uniformity trial, New Zealand workers (*N.Z. J. Agric.*, **77,** (1948), 116) estimate the twin method to be as much as 200 times more efficient in milk production studies. Though this means that twin experiments can be reduced in size without decreasing reliability, it must be remembered that there must be sufficient experimental animals to represent the normal population.

Results of experiments so far reported come mainly from Sweden, where Bonnier has used his collection to carry out experiments on the effect of various levels of nutrient intake on growth and milk production. (Bonnier and Hannson, *Acta Agric. Suec.*, **1** (1946), 171-205 ; Bonnier, Hannson and Skjervald, *Acta Agric. Suec.*, **3** (1948), 1-57 ; Hannson, *Acta Agric. Suec.*, **3** (1948), 59-70).

In another sphere, Hannson and Bonnier (*Acta Agric. Suec.*, **2** (1947), 311-8) have used twins to compare the effects of twice and three-times daily milking on the yield and quality of milk, and Hannson (*Acta Agric. Suec.*, **3** (1948), 71-4) has measured the effect of premature parturition on milk secretion.

The use of twins in animal disease investigations shows promise, especially where heredity plays an important part in the resistance to the particular disease concerned. Hannson (*Acta Agric. Suec.*, **1** (1946), 163-9) reports the death of twins within a few days of each other after eating mouldy hay. Post-mortem examination showed a mycotic

intestinal infection ; none of the other twins who received the hay was affected. This worker has also used twins to measure the effect of mastitis on milk yield and has studied the compensation on non-infected quarters (*Acta Agric. Suec.*, **1** (1946), 153-62).

Another important use of twins is in a field of research work which has up to the present been neglected—that of animal behaviour. Monozygous twins have been successfully used for studies in human behaviour, and Hancock (*N.Z. Dairy Exptr.*, **24** (1948), 18-22) has given a promising preliminary report of the value of bovine identical twins in grassland management studies.

A.S.F.

POULTRY HUSBANDRY

Breeding

With an increasing interest in improved poultry breeding, many poultry breeders are in danger of being saddled with the onerous task of accumulating and attempting to make use of a mass of records. A paper by F. J. Dudley on " Poultry Breeding Records " published in the *Harper Adams Utility Poultry Journal* (**34,** N.S. 1, 50-55) is therefore a timely reminder of the value to be placed on records. Dudley emphasizes the fact that the keeping of records is both a time-consuming and costly task, even when well organized. He points out that recording for its own sake is valueless, and that the breeder should decide what information he requires and how best to obtain it. The author illustrates the increasing scope of the problem when more than one factor is involved, and brings a refreshingly commonsense opinion to bear on the danger of the enthusiast being deceived into relying too completely on figures alone—without full realization of exactly to what his records relate. Illustrating this point, Dudley refers to the difficulty of differentiating between the performance of the progeny of an outstanding sire mated to a moderate bunch of females and that of the progeny of a moderate sire mated with outstanding females. There might be no difference as far as the production records of the two different samples of progeny are concerned.

Feeding

The interest taken of necessity in this country in the use of waste materials as a source of poultry food appears to have reached the United States, and the *Delaware Agricultural Experimental Station Technical Bulletin No.* 958, published by the U.S. Department of Agriculture, deals extensively with the " Preparation and Use of Leaf Meals from Vegetables Wastes " by J. J. Willaman and R. K. Eskew. This bulletin deals with the feeding value of leaf meals prepared from beet tops, broccoli, kale, turnip tops, etc. The authors find that these substances are rich in carotene, riboflavin and protein and have a low fibre content. The writers conclude that these meals provide an excellent food for poultry and that their value seems roughly parallel with their carotene content.

On a more detailed aspect of the feeding of green food is an interesting paper by H. Temperton and F. J. Dudley on " The Biological Activity of the Xanthophylls of Grass in Metabolism," published by the *Harper Adams Utility Poultry Journal*, **34,** N.S. 1, 37-49. The authors fed groups of chicks up to 4 weeks of age with a basal diet minimal in carotenoids and containing no pre-formed vitamin A. To one group vitamin E in the form of α-tocopheryl acetate was added; to the second group was added a carotene-free xanthophyll extract of dried grass. In the first group deaths from avitaminosis-A occurred, but the incidence of mortality appeared delayed, and the authors consider that this delay was caused by the supplement conserving the initial vitamin A reserves of the chick from the hatching egg and promoting its more efficient utilization. In the second group the mortality rate was lower than that in the group receiving the unsupplemented basal diet. The authors conclude that xanthophylls in grass possess biological activity for young chicks, and further work on the mechanizm of its possible action is projected.

Recently two papers have appeared dealing with a relatively new subject —that of radioactive materials. Although this work is at present chiefly of use to the researcher, the findings of the authors are of interest in indicating the rapidity of utilization of phosphorus (Spinks *et. al.*, " The Use of Radiophosphorus (P^{32}) to measure Phosphorus Utilisation by Laying Hens," *Canadian Journal of Research* **26,** (1948), 163-76), and both rapidity and degree of utilization of calcium is dealt with in a paper by Comar and Driggers, " The Secretion of Radioactive Calcium in the Hen's Egg," *Science* (1949), 109.

Research—Genetics

Poultry have an advantage over many other forms of livestock in that they are often used as research media. In this manner many important facts relating to poultry have been revealed, although the aim of the researcher was not directly concerned with poultry. This matter is illustrated by an article by Greenwood, Blyth and Carr in the *British Journal of Cancer*, **2** (1948), 135, " Indications of the Heritable Nature of Non-Susceptibility to Rous-Sarcoma in Fowls ". The authors refer to the findings that one line of the inbred Brown Leghorns at Edinburgh was highly resistant to the production of fatal cancer by inoculation with Rous No. 1 virus. This work may be of great value in connection with fowl paralysis.

Of some interest to poultry-keepers is Bulletin No. 443 published by the Massachussetts Agricultural Experimental Station, July, 1947. The author, F. A. Hays, gives an excellent account of the inheritance of intensity of laying in Rhode Island Reds. His conclusions relate to clutch size during the four seasons. Hays considers that the simple correlation coefficient between mother and daughter is not a satisfactory measure of heritability, but that there is a significant relationship between mothers and daughters for winter and spring clutch size. He considers the dam's spring clutch size to be more important than those at other seasons of the year. Hays concludes by stating that the mean performance records of families of daughters is the best measure of the breeding ability of females.

Recently interest in hybrid chicken has increased, and, apparently, the sales of hybrid chicken in the U.S.A. have almost doubled during the last year. A paper—Purebreds, Crosses and Hybrids—on the comparative importance and development of the hybrid chicken industry is published by the *U.S. Egg and Poultry Magazine* (April, 1948), 18. The author, T. C. Byerly, gives an account illustrating the difficulty of improving pure breeds, and emphasizes the importance of inbreeding to fix genetic factors and the ultimate improvements to be achieved in production by crossing these inbred lines.

R. C.

ENTOMOLOGY

Observations on the Raspberry Cane Midge (*Thomasiniana Theobaldi*, Barnes) **and its Association with Cane Blight.** Pitcher, R. S. *Ann. Rep. E. Malling Res. Sta.* (1947-48).

The life history of the midge is described, beginning with the emergence in late April or early May of the flies which each lay some 70 eggs in the young canes. The larvae feed under the epidermis and later fall to the ground and pupate in cocoons. Second generation flies emerge in July and a third generation appears in August.

Attacked canes exhibit superficial brown blotching. Splitting of the epidermis and injuries of various kinds are sought by the females as egg-laying sites. During July and August, when the cane is maturing, the cortical tissues split and peel back and provide many suitable egg-laying sites. In severe cases the lower 12-18 inches may be discoloured and serious cane death may be the result, largely as the result of the feeding of the larvae in the cork cells, thus depriving the cane of its natural protection.

In the later stages of the attack the canes become very susceptible to fungal attacks and the combined attacks may result in up to 75 per cent loss of cane.

Susceptible varieties are *Bath's Perfection*, *Newburgh* and *Malling Enterprise*.

The control of Cane Blight direct is most difficult, and the aim should rather be to deal with midge attacks which are the predisposing factor. A spray containing DDT applied to the young canes shortly before the first midges emerge has given encouraging results in preliminary experiments.

A Preliminary Report on the Strawberry Eelworm (*Aphelenchoides fragariae* Ritz. Bos). Dicker, G. H. L. *Ann. Rep. E. Malling Res. Sta.* (1947-48).

A short account is given of the history of eelworm attacks on strawberry, reference being made to early observations by previous workers in connection with Red Plant and Cauliflower disease ; also the somewhat similar diseases described in the U.S.A. under the names of Dwarf, Crimp, and Spring and Summer Dwarf.

Symptoms of eelworm attack, as observed in the field, are described, these taking the form of discoloured areas on the leaves with a rough,

hard surface, the leaf laminæ often being puckered and twisted. The possible connection between these symptoms and Red Plant is discussed.

In experiments on sixteen plants inoculated with *A. fragariae*, thirteen developed symptoms similar to those observed in the field. No symptoms of cauliflower disease were obtained.

Biological observations have shown that the main eelworm population lives in the crowns of the plant, the growing tip of which may be killed, giving rise to secondary crowns. Preliminary experiments indicate that warm water treatment at 110° F. for 20 minutes is unlikely to give control. At the moment the most satisfactory method is the roguing of infested plants from runner beds in March, May and late summer.

A Small Type of Home-made Dusting Machine for Ridge and Rowcrop Work. Staniland, L. N. and Mayor, J. *Agriculture*, **56**, 1 (1949) 34-8.

This article should be read in conjunction with previous articles on home-made dusting machines in the same Journal.

The duster described is a small hand-drawn version of a previously described row-crop machine, which should be of special value on intensive holdings and small farms. The principles of construction are similar, but this latest model is smaller, lighter and simpler ; the cost is much lower—not more than £1 if some scrap wood is available. Information on construction and use is given, illustrated by diagrams.

Destruction of Queen Wasps by Spraying. Palmer-Jones, T. *N.Z. J. Agric.* (December, 1948).

Some plants act as natural lures for the queen wasps of the two common species, by reason of the honeydew excreted by insects infesting them. Such plants when sprayed with DDT may then act as poison baits which can provide a valuable means of destroying the queen wasps. Plants in New Zealand which have been found to be useful in this way are described, among which are hawthorn and poplar, which occur in this country. In experiments it was found that 1 oz. of 100 per cent DDT per gallon of water was sufficient when sprayed over the leaves to cause immediate symptoms of poisoning in the wasps, followed by death in a few hours.

L. N. S.

MYCOLOGY

Seed-borne Fungi

The importance of this subject has been emphasized by a number of recent papers. At the Jubilee meeting of the British Mycological Society, Miss Doyer[1] described the methods which were used at the Dutch Seed Testing Station, Wageningen, for the identification of fungal parasites carried in or on seed. She also discussed the importance of the various diseases caused by these fungi in Holland. The need for international co-operation to obtain uniform methods of seed testing was also stressed.

At the same meeting, Professor Muskett[2] gave an account of the methods used in Northern Ireland for the detection of seed-borne

fungal parasites. For oats the method used in testing the control of *Helminthosporium* obtained by seed disinfectants had been adopted for routine seed-testing. The Ulster method for examination of flax seed enabled *Colletotrichum linicola*, *Polyspora lini*, *Botrytis cinerea*, *Phoma* sp. and *Fusarium lini* to be detected readily. He claimed that no other method was so rapid and efficient. Perennial ryegrass was tested for the presence of the fungus causing blind seed disease by placing single seeds in a spot of water on clean microscopic slides. After removal of the glumes, the macrospores of the fungus *Phialea temulenta* float out in large numbers from infected seed and can quickly be identified under the microscope. Where it was necessary to test the viability of the spores, the method of Neil and Hyde for isolating the fungus was used.

To ensure healthy crops it was desirable to devise simple, rapid and cheap methods of examining seeds and all other propagating material. Before this could be done for any particular seed it seemed to be essential that surveys should be carried out both nationally and internationally in order to obtain definite information on the parasitic fungi occurring on that seed. The presence of seed parasites was not determined by routine seed testing methods now used. For example, although many of the flax seed samples produced in the North and West of Britain had a high degree of purity and a germination of over 90 per cent, they were often contaminated by fungi. Moreover, it had been shown in Northern Ireland that if seasonal conditions were favourable there was a rapid build-up of parasitic fungi if repeated sowings were made from the same stocks. However, under the present position of legislative control, all these samples would be accepted as first quality seed. The technique used for testing seed samples was doubly important, as with slight adaptation it could be used for assessing the value of seed disinfectants used to prevent the diseases caused by seed-borne fungi.

Colhoun and Muskett[3] have made a number of observations during the period 1939-47 on seed naturally contaminated with *Colletotrichum linicola*, *Polyspora lini*, *Botrytis cinerea* and *Phoma* sp. Under ordinary conditions of storage the longevity of these seed-borne parasites varied within the following limits :

Colletotrichum linicola, 26-69 months.
Polyspora lini. 16-55 months.
Botrytis cinerea. 16-40 months.
Phoma sp. 27-43 months.

The data suggest that the higher the percentage of seeds contaminated with *P. lini*, the longer will be the time taken for the parasite to die. Prolonged storage was not likely to control the diseases caused by these seed-borne fungi, as their life is greater than the safe storage period for the seed. By the time all the parasites had died the germination of the seed was usually seriously impaired.

Methods used for treating vegetable seeds for control of diseases have been described by J. C. Walker[4], and treatment with seed disinfectants and seed protectants is discussed. The materials available, particularly in the United States, are described and details given of current recommendations. The author stresses the need for further research on the interaction between the chemicals used, the parasites

and their hosts, and external conditions. There is also a need for improved materials and methods of treatment. A further urgent requirement is accurate and rapid methods by which the principle pathegons may be determined.

In this country, Canker of broccoli, caused by *Phoma lingam*, appears to be causing increased concern in the northern and midland counties, where it is becoming more and more prevalent. The disease has been described by Millard[5] and control measures suggested. He showed that good control of the disease could be obtained by treating the seed in water maintained at 122°F. for 25 minutes. A better method was to obtain disease-free seed by sowing seed previously treated by the warm-water method in isolation from all other cruciferous crops and roguing out all infected plants during the growing season.

H. E. C.

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VIROLOGY

Yellows or Xanthosis in Strawberries in Eastern United States. Demaree, J. B. *Plant Dis. Reptr.*, **32** (1948), 428-32.

This is a description of the reaction of strawberry varieties to Yellows (Yellow Edge) in the eastern and western states of the U.S.A.

Since the aphis vector (*Capitophorus fragariae*) is not widely distributed in the eastern states, it is recommended that virus-free stocks of strawberries should be propagated in areas where the aphis is absent and sent to growers for mass production under State regulations.

For setting new plots, growers are advised to select only vigorous plants with large, green, smooth leaves, upright petioles and heavy runner production. Testing to an indicator plant is also recommended, to make sure the virus is absent.

Ein Schnellverfahren zum Nachweis des Kartoffel-A-Virus (vorlaeufige Mitteilung). Kehler, E. *Kartoffelwirtschaft*, Hamburg, **1** (1948), 56.

In the identification of viruses affecting the potato crop, the use of *Solanum demissum* as an indicator plant for potato virus A is recommended. Blackish-brown spots develop on the inoculated leaves. The development of lesions is accelerated if the leaves are removed after noculation and kept in a Petri dish on damp filter paper, out of direct sunlight.

Over de identiteit van het ratelvirus van de Tabak en het stengelbontvirus van de Aardappel. Rozendaal, A. and Van der Want, J. P. H. *Tijdschr. PlZiekt-liv*, **4** (1948), 113-33. (English summary.)

This paper connects the Potato Stem Mottle virus with the " Ratel " virus of tobacco, both diseases occurring in Holland and Denmark but not in the U.K. It is an interesting virus in that it is soil-transmitted, apparently without an insect vector. The authors consider that the virus has a rod-shaped particle.

Resistance to Spotted Wilt in Tomato. Holmes, F. O. *Phytopath.* **38** (1948), 467-73.

Under New Jersey conditions, a new type of resistance to Tomato Spotted Wilt was found in the Argentinian tomato varieties Rey de los Tempranos and Manzana. It is inherited as a single Mendelian factor. The author found that chickweed (*Stellaria media*) was an important host for the Spotted Wilt virus and that it had a considerable influence on the spread of the disease in dahlias grown in the vicinity of this weed.

Photosynthesis and Predisposition of Plants to Infection with Certain Viruses. Bawden, F. C. and Roberts, F. M. *Ann. appl. Biol.*, **35** (1948), 418-28.

The effects on susceptibility to infection with certain viruses of subjecting plants to various periods of darkness or reduced illumination before and after inoculation were tested. The viruses and hosts used were a Tobacco Necrosis virus in French bean and tobacco ; Tomato Aucuba Mosaic virus in tobacco ; and Tobacco Mosaic and Tomato Bushy Stunt viruses in *Nicotiana glutinosa*. All the virus-host combinations give necrotic local lesions, and susceptibility was measured by local lesion counts. Susceptibility was consistently increased by pre-inoculation treatments of host plants, whereas post-inoculation treatments had relatively little effect, but most often decreased susceptibility.

Short periods in the dark produced similar responses to longer periods in the shade, but the different plants varied in their response to, and tolerance of, darkness. The maximum number of lesions was usually obtained with bean plants kept for 24 hours in the dark before inoculation, but with tobacco plants susceptibility increased with increasing time in the dark up to five days.

It is suggested that the successful establishment of infection occurs in two stages, the first of which is affected by the accumulation of photosynthetic products. Whether these products confer resistance by increasing cell turgor or by reacting specifically with virus particles is unknown, but sap from plants in the light possesses no greater virus-inhibiting power than sap from plants kept in the dark.

K. M. S.

PROVINCIAL NOTES

FARMING PROBLEMS OF THE EAST MIDLANDS

It will hardly need emphasizing that not more than a cursory reference to the rich variety of agriculture and its more pressing problems is possible in the space alloted to this description of the East Midlands.

The East Midlands Province of pre-N.A.A.S. days comprised the six counties of Kesteven, Lindsey, Notts, Rutland, Leicester, and Derby, and it was in that area that so much sound advisory work had been carried out. With the coming of unified control of advisory work, the rearrangement of the counties brought Northamptonshire into this Province.

Some idea of the area may be gained from the fact that it extends for 124 miles, from Grimsby almost to Oxford, in one direction, and for 94 miles from the potteries to the sea in the other. In general, the topography is rolling, sometimes flat and occasionally depressed. Derbyshire alone is different, and there only in the North, where the land rises to the mountains of the Peak. Through Leicestershire, Rutland and Northants, extending into Lincolnshire, are the most famous fox-hunting areas in the country, a sport which has sometimes, but by no means invariably, been associated with good farming and high production.

General Farming

The standards of arable husbandry vary so much from county to county and from district to district that any sort of generalization would be well-nigh impossible and, therefore, misleading.

To appreciate the variety of arable farming, is to appreciate the variation in soils. Geologically, almost every formation from the Archaean slates of Charnwood to the present-day silts and peats can be found. If any sort of generalization were possible, then it would be fair to say that the highest production would be found in the silts, peats and warp soils of Lincolnshire, and equally that the lowest would be in the hills of Derbyshire. It is everywhere apparent, as must be true of all parts of the country, that ample scope for improvement in arable production exists. Equally, it is obvious that in the field of increased production a great future exists for farmers and the advisory service alike. However, increasing production can become a feature of our agriculture only if long-term economic stability in our industry is assured.

If the principle of ley farming is ultimately established then one may presume that the classic distinction between grassland and arable will disappear. One cannot help thinking, however, that that time is still a long way off, and for the few farmers who are becoming ley-minded there are vastly more who are not.

The war-time turnover from the predominantly grass conditions in Leicestershire, Rutland and Northants has to be seen to be believed. The Table below illustrates this point by comparing conditions immediately pre-war with those of the peak years of the ploughing-up campaign.

	Grassland *acres*	Arable *acres*
1939	820,459	206,715
1944	429,772	581,652

Except in the Market Harborough district and in a limited number of similar areas where the maintenance of permanent grassland is of a traditionally high standard, it would be fair to say that a vast field for improvement in production is ripe for exploitation. Passing along the roads, one sees so much old turf that is relatively so unproductive as to admit of no economic improvement except by starting with the plough. On the better types of grassland much can be done by surface treatment, and while vast quantities of lime and fertilizers have been applied to arable land, relatively little has been applied yet to the grassland. It has not hitherto been the tradition to lime grassland, and there is here a great opportunity awaiting exploitation, both by precept and example. It should be emphasized that the problem of grassland improvement in so many areas is tied up with the provision of fixed equipment in the shape of better buildings and water supplies. Attention to these points is of fundamental importance.

W. Morley Davies.

Sandland Farming in the Sherwood Forest Area of Nottinghamshire

A very large part of Nottinghamshire—perhaps a quarter of the total area of the county—consists of Bunter Pebble Beds, bounded on the East by Keuper Sandstone and on the West by Magnesian Limestone. Some of the land is forest or scrub, some is newly planted by the Forestry Commission or by private owners, but most of it is under cultivation. The soil is all porous sand, sometimes full of pebbles, sometimes podsolized, and there is, of course, a fair degree of variation in productivity. All parts suffer from the risk of drought, and certain areas could quite properly be described as marginal. The rainfall is about 24 inches a year, but distribution is uneven, and it is not uncommon, in dry and windy spells, to drive through a " Khamsin " which eventually leaves the road inches deep in sand, fortified, no doubt, by fertilizer or seeds, according to the time of the year.

The problems are mainly chemical and physical—the generally high acidity, the porous nature of the soil, and uneven rainfall—but there is also a mechanical problem created by the steep undulations of much of the Bunter. Crawler tractors suffer heavily from abrasion of the tracks, spade-lugged tractors dig themselves in. Rubber-tyred tractors with plenty of rear wheel adhesion are essential.

In the past, arable sheep, incorporated in the Norfolk four-course rotation, were used to maintain fertility, but the financial weakness of

this system has driven the more progressive farmers to seek new methods. There is urgent need to compare the soundness of these new systems, the chief of which are one-year leys mown and ploughed in for potatoes, three-year grazing leys, and long-duration stands of lucerne, usually with cocksfoot. The district, because it will not hold grass in the summer, does not favour dairying, but the use of lucerne as a summer standby may encourage the replacement of yarded bullocks by " bailed " cows as a source of humus. The main cereal crops are oats and rye, some parts of the sand grow good sugar beet, and during the last few years there has been a fourfold increase in the area of potatoes.

During the last ten years, thanks to war-time economics and a succession of unusually damp summers, the Bunter Sand farmers have enjoyed a reasonable income, but they are all conscious of the bitter experience which allows them to rely only on one good season in three, and there is no doubt that, if price levels turn against this kind of farming, the Advisory Service must be ready with the answers.

N. F. McCann.

Hill Farming in Derbyshire

The area which may be regarded as hill land in Derbyshire extends to some 250,000 acres, or just over two-fifths of the county. Of this area, approximately 100,000 acres is carboniferous limestone, affording much good grazing ; 70,000 acres is sheep moor and the remainder gritstone soils of varying qualities. The limestone plateau is bleak and exposed stone wall country at altitudes varying from 800 to 1,500 feet O.D., while the gritstone is generally hill and dale country rising in the High Peak to over 2,000 feet O.D. Dairying, stock rearing and sheep are the principal methods of husbandry, the breeds of sheep kept being mainly Derbyshire Gritstone, Swaledale, and Lonk.

While oats and roots are widely grown, it is, of course, to the improvement of his grassland that the hill and marginal farmer must look. Much of the permanent pasture is *Agrostis* and fescue dominant, and experience has shown that there is over most of north-west Derbyshire a fairly high degree of soil acidity. The practice of liming here is age-old, and liming along with mechanical cultivations is being widely practised and encouraged. During and since the war years a technique of ploughing old turf and direct reseeding has been developed which has proved of inestimable value. The County Committee, using a team of crawler tractors, has itself reseeded some 4,000 acres of hillside land, and most of the larger farmers are following this example.

The lot of the hill farmer with the benefits he may obtain under the terms of the Hill Farming Act of 1946 is greatly improved, and the Act is providing many of them with the incentive and the means to improve the stock-carrying capacity of their farms. The small hillside farmer whose holding is truly marginal is not so well placed, and many are now having difficulty in making ends meet. How to provide capital with which to improve their farms is an outstanding problem.

L. M. Waud.

Restoration Problems Associated with Ironstone Workings

In a triangular belt, with its apex near the Humber and base at the southern end of Northamptonshire, occur ironstone beds associated with the middle lias clay or with inferior oolite limestone and estuarine clays and sands, the latter frequently capped with medium to heavy boulder clay. Small quarries have operated for many years, but at present, particularly in Northamptonshire and its near borders, extensive sites are being worked. In the near future these will be extended to cover some 150 square miles. Whether restoration takes place or not at present depends both on the type of overburden and the method of working.

Where the overburden is shallow, or where a dragline is used in workings up to 30 feet in depth, direct restoration of the sites can be, and very often is, carried out. In deeper workings and in all cases where a digger-type excavator is used, restoration presents many difficulties and can be tackled only as a secondary operation.

At present in such workings the various strata of the overburden are mixed during excavations and deposited as spoil in deep ridges or " hill and dale ". The material so exposed varies considerably. It can be almost anything from pure sand to impervious clay of the estuarine series, limestone brash or limestone blocks weighing up to 15 tons of the inferior oolite, black " coaly " material containing free sulphuric acid with a *p*H of 2.0, boulder clay or a mixture of any of these.

The first step towards restoration is levelling the " hill and dale ". Where limestone blocks occur near or at the surface great difficulty is experienced in burying them with sufficient tractable material during levelling. Where sufficient tractable material remains after levelling, a medium is provided for " soil " making. Invariably such material is deficient in phosphate, almost devoid of nitrogen, as well as being almost sterile. Thus heavy applications of complete fertilizer are necessary before attempts at rehabilitation are made. Moreover, it will be necessary to improve the texture of this soil and introduce humus, preferably by putting down to grass for a few years. Where the soil is extremely heavy such areas would, for a long period, better remain down to permanent grass. Where the soil is lighter, after a temporary period down to grass, such land will ultimately be used for arable crops.

To avoid spoliation of too much land in the future, and to facilitate restoration, attempts are being made to insist on the replacement of top soil over levelled sites. Naturally such a scheme is mainly the problem of the engineer, but in the national interest every effort should be made to get it into immediate operation.

For some time experiments in grassland restoration have been carried out jointly, and they have clearly demonstrated that even the most intractable clay subsoils can be made to produce grass, especially if care is taken to include legumes and to see that adequate fertilizers are used.

J. W. Blood.

Problems arising on Restored Opencast Coal Sites

Some thousands of acres of land in Leicestershire, Derbyshire and Nottinghamshire are at present affected by the winning of coal by opencast methods. The problem of restoring these disturbed areas to agriculture will naturally vary from site to site, but the main difficulties are common to all.

When operations begin, an 18-inch layer of soil is stripped and deposited at a corner of the site. Mining will then operate to a depth of up to 200 feet, using dragline methods for restoring, which means that all the layers of the overburden are mixed together. When mining is completed, the land is levelled by bulldozers and scrapers and the 18 inches of soil deposited on the surface.

The problems confronting the technical adviser are :

(*a*) *Fertility*. Most of the sites in the East Midlands are on land inherently poor (coal measures), and the true soil is often less than 18 inches. When restored, the land is almost sterile and heavy dressings of NPK have to be applied. When this is done, grass establishes well and the legumes are generally abundant and vigorous. After the first season there is often rapid deterioration of the sward. This may be due to lack of fertility, the NPK which was applied having become no longer available, to under-grazing during April and May, to wet conditions created by inadequate drainage, or to combinations of these conditions.

(*b*) *Drainage*. This is one of the major problems connected with the regrassing of these areas. During the process of getting the coal all existing drains are destroyed and, owing to subsidence which occurs for some years after, drainage is almost impossible, and much trouble arises from excessive water. The result is a tendency for water to remain in pools on the surface.

(*c*) *Water Supplies*. Effective grazing of the new area cannot be carried out without adequate water supplies, and there is, therefore, a tendency to take hay off the newly reseeded fields, which results in much damage to the sward and particularly the legumes.

(*d*) *Arable Cropping*. Some of the areas have been successfully cropped with cereals, but, in the main, cereals remain stunted throughout. Again, in a wet season it is almost impossible to remove the crop owing to waterlogging.

O. G. Williams.

The Potato Root Eelworm

The potato root eelworm has now become a major problem in the East Midland Province. For some fifty years Lincolnshire farmers have developed potato-growing into a highly skilled and well-organized industry. This has resulted in cropping too frequently, and a large acreage in the county is now potato sick. The demand for the crop continues to be great. There is an inevitable tendency for the expert growers to spread into adjacent parishes or even adjoining counties. Infection of the soil invariably follows. Of over 30,000 acres sampled in what might be termed the bad parishes, over 20,000 acres had measurable infestations of potato root eelworms. The general world conditions

since 1914 have brought this about. The sickness in the fields began during the first World War and the position has steadily deteriorated since then. The eelworm is appearing in new parishes, and about a dozen parishes in Nottinghamshire now have farms infested.

Although no cure was found between the wars, entomologists did become accustomed to handling and counting the cysts and associating cropping results with the various counts. It is possible, therefore, to limit the damage caused by this pest.

In areas where the eelworm is not yet well known to cause failures, inspection of the growing potato crops in summer may nevertheless reveal its presence. The farmer can then be told in which fields it occurs and can then crop those fields less frequently with potatoes.

On infested farms cyst counts enable the farmers to know the varying degree of infestation in the different fields. Armed with a complete picture of his farm, it is usually possible for the grower to arrange his cropping to produce maximum crops and so reduce the effect of the eelworm to a minimum. If, by some easy means, groundkeepers can be destroyed, no breeding can take place in the years between the potato crops. By such means it is hoped to limit the ravages of the pest until some reliable cure can be obtained.

A. Roebuck.

NATIONAL GLASSHOUSE LETTUCE TRIALS: II

E. E. Skillman

Eastern Province

The summer issue of the N.A.A.S. Quarterly Review (pp. 189-92) dealt with the heated trials of the varieties *Cheshunt Early Giant*, *Cheshunt 5B*, *May Queen*, *Early French Frame*, *Cheshunt Early Ball*, and *Gotte à Forcer*. This article deals with a trial of seven varieties grown "cold," namely, *Arctic King*, *Attracte*, *Cheshunt Early Ball*, *Gloria*, *May Queen*, *Northern Queen* and *Winter Crop*. Owing to acute staffing difficulties in the County Horticultural departments of the N.A.A.S., out of seven centres where results were recorded, only those from Worcester and Cornwall were suitable for statistical analysis, the other counties being Buckinghamshire, East Sussex, Lancashire and Yorkshire (Scarborough and Cottingham). The experiment was carried out on similar lines to the heated trial, the lay-out being in 7 x 7 latin squares, except in Cornwall and Lancs, where the design consisted of four randomized blocks of seven plots each.

Sowing and Planting. Sowing dates varied from late October to end of December. The crop was planted out in the last week of January, with the exception of Cornwall (early Jan.) and Cottingham (Feb.). Spacing of the plants varied, the most general being 9 inches x 10 inches.

Disease, etc. Losses from *Botrytis* were on the whole not heavy, except in Worcestershire, where there was a loss of 11 per cent. *Northern Queen* and *Cheshunt Early Ball* were the most heavily infected varieties, with *Attracte*, *Winter Crop* and *May Queen* following closely. The most resistant were *Gloria* and *Arctic King*. Slight tip-burn occurred at two centres and was attributed to lack of water. The crop at all centres was mainly very free from Mosaic.

Cutting. The cutting dates varied ; the earliest crop to be cleared was in East Sussex, at the end of March. The Buckinghamshire crop was not cleared until May 4, but this was due to exceptional circumstances, and some plots here had in fact begun to deteriorate owing largely to a spell of very hot weather at the end of April.

Marketable Plant Number. There were four grades : I (24 pack, 6 oz. and upwards) ; II (30 pack, 4-6 oz.) ; III (36 pack, below 4 oz.) ; and unmarketable. On the whole the variability of the figures was high, the standard error per plot exceeding 16 per cent in Bucks and Worcs. In Yorkshire (Cottingham), where the spacing was 9 inches x 8 inches, the number of marketable heads of *May Queen*, *Gloria* and *Early Ball* exceeded 80,000 per acre, but *Arctic King* at the same spacing was as low as 30,800. Taking the figures from nine centres as a whole, *May Queen* and *Gloria* at the top of the list show no significant difference. They are closely followed by *Northern Queen*, *Attracte* and *Early Ball*, with *Winter Crop* and *Arctic King* last. But the position of *Arctic King* is adversely affected because at one centre (Bucks) none of this variety was marketed. At the Cornwall, Lancs and Worcs centres *Arctic King* was better placed in the lists of marketable plant numbers.

Marketable Weight has been calculated in terms of tons per acre of actual growing space. It reflects the number of marketable lettuces, and *Early Ball* gave a markedly lower yield than all other varieties in Worcs and in Bucks, neglecting the two varieties which failed in the latter. The only other significant effect shown by the results is the superiority in yield of *Winter Crop* over all other varieties in Worcs, and of *Attracte* over *May Queen*, *Gloria* and *Arctic King* at Scarborough. In Cornwall also *Winter Crop* gave the highest yield, followed by *Northern Queen*. The average weights per head for each variety were calculated, and the figures indicate that *Gloria* was consistently of a high grade, followed closely by *May Queen*, *Arctic King* and *Attracte*, then *Winter Crop*, *Northern Queen* and *Early Ball* in that order. Exceptional yields were obtained at the Bucks trial, the average weights (in oz.) being *May Queen* (18.3), *Attracte* (17.9), *Gloria* (17.7), *Northern Queen* (17.2), *Winter Crop* (16.4), *Early Ball* (14).

Market Qualities. Marks for earliness, overall size, size and firmness of heart, leaf texture and size of core were given near the time of cutting. The mean figures for all attributes at seven centres were as follows : *May Queen* (8.5), *Gloria* (8.4), *Cheshunt Early Ball* (8.0), *Attracte* (7.9), *Northern Queen* (7.6), *Arctic King* (6.7), *Winter Crop* (6.0).

Earliness. *Cheshunt Early Ball* (8.4) was the earliest variety to mature, followed closely by *Gloria* (8.4) and *May Queen* (8.2). These

were followed by *Northern Queen* and *Attracte* (each with 7.4), *Arctic King* (6.0) and *Winter Crop* (5.4).

Overall Size. *Attracte* (9.2) scored a slightly higher mark than *Gloria* and *Northern Queen*. *Early Ball* (5.8) was at a distinct disadvantage.

Size and Firmness of Heart. *Winter Crop*, a fairly large loose lettuce, was lowest in the order of merit in these classifications. *Arctic King*, a smaller lettuce, came next. There was little difference in size of heart between the other varieties, but *Early Ball* hearted well for its small overall size. For firmness of heart, *Early Ball* (9.4) headed the list, followed by *Gloria* (8.6), *May Queen* (8.2) and *Attracte* (7.7).

Conclusions

As the results at many centres were incomplete, it is not possible to draw any firm conclusions. The available records indicate that for general market qualities there is practically nothing to choose between *Gloria* and *May Queen*, although the latter showed slightly more susceptibility to *Botrytis*. *Attracte* and *Northern Queen* were good lettuces on the whole, *Attracte* having the advantage in respect of marketable number and size of heart. *Arctic King*, although smaller than *Winter Crop*, hearted better and matured earlier. *Cheshunt Early Ball* was the smallest lettuce in the trial, but it hearted well and matured much earlier than the others.

The notes on this trial and the heated trial would not be complete without acknowledgment to all those N.A.A.S. officers who supervised and recorded the trials, often under difficult conditions, and to the growers who so willingly co-operated.

CROP PRODUCTION WITH DUTCH LIGHTS IN YORKSHIRE

P. H. Brown

Yorks and Lancs Province

The introduction of Dutch lights into Britain in the early 'thirties of this century to aid crop production marked the beginning of an industry which now forms one of the most popular sections of commercial horticulture. Two events which occurred about 1932 had the effect of stimulating growers in certain parts of this country to take up the Dutch method of production : first, the imposition of import duties on early horticultural produce, and secondly, the arrival of the Dutch " settlers " who began business in East Yorkshire and around Spalding in Lincolnshire and set an example which English growers, particularly those in East Yorkshire, were not slow to follow.

Crop Production with Dutch Lights in Yorkshire

The fact that Advisory Officers in many parts of the country now find themselves frequently called upon for help and advice on the subject of Dutch light culture points both to its popularity and the extent to which the practice is spreading throughout the country. A short account of its development in East Yorkshire indicates how experience gained under local conditions successfully laid the foundations of today's extensive industry in that part of England.

It was about 1933, when local growers were struggling to offset the effects of the economic depression, that the first few Dutch " settlers " arrived in the Hull district. They quickly acquired land and erected frames and glasshouse structures, and within six months were marketing large quantities of early lettuce and other crops in Hull. A combination of energy and determination was the keynote of their success. Local growers soon perceived that in this new method of production there lay a solution to their problems, and the locality quickly began to acquire a " new look," with frames and structures springing up on many of the market gardens. From that time development has been rapid and the industry is still expanding. The present area of land occupied by " Dutch glass " in East Yorkshire is over 200 acres, and produce is now consigned to most of the principal markets throughout the Midlands, the North, and Scotland.

As a result of the experience gained, what are the important points now observed by local growers whose business is mainly production with lights, and do they constitute the fundamental principles of success ? Certainly this experience has determined a pattern which, subject to the wisdom of modification in the light of changing conditions, is worth studying.

Primarily, experience has shown that, except perhaps in a few special instances, production with lights alone is not always an economic proposition ; it should be combined with outdoor crops. Crops from lights are somewhat seasonal, and this fact raises two points of considerable economic importance : without additional crops at other seasons of the year, there can be no continuity of supplies for a given market ; secondly, there is a lack of balance in the work of the holding's staff. Experience suggests that to obtain a balance of production and labour the acreage ratio of " glass " to outdoor crops should be approximately 1 : 4, and a labour force of about 1½ workers per acre is required for this combined production.

The outdoor crops are chosen with the greatest care to combine with those under glass. For example, summer cauliflowers are always grown so that output of this crop from both the glass and open land provides as long and continuous a supply as possible for the market.

A visitor to a " Dutch glass " holding in Yorkshire would observe—and indeed be fascinated by —the manner in which a high output of produce is obtained at the lowest possible cost ; this is the essence of the system. In the first place, equipment is always of simple and standardized design, thus providing protection at a relatively low cost. Cultivation within the frames and structures is largely mechanized,

and watering is done mainly by overhead irrigation. The lights are kept in continuous use over the greater part of the year, either on frames or structures, or both. Although in other parts of the country lights are used almost wholly on frames this is not the practice in East Yorkshire, where fully one-half of them are used on structures which are, in effect, a type of glasshouse.

The reasons for this are worth examining. A structure will produce an earlier spring crop (lettuce, for example) than a frame, its height allows for a crop of tomatoes which is (usually) a more remunerative summer crop than those that can be grown in frames, and—most important of all—crops in structures require less labour in handling than those in frames. Against these advantages must be weighed the extra capital cost of the structure and the necessity to move it every few years on to fresh soil. In East Yorkshire the areas of frames and structures are about equal, indicating that each has its appropriate place ; indeed, some of each are found on all holdings.

The principal crops grown in structures are early lettuce and tomatoes ; and, in frames, lettuce, cucumbers and melons. The intercropping of frame lettuce with early cauliflower is widely practised. Some flower crops, such as bulbs in frames and sweet peas and gladioli in structures, are now attracting attention.

From the 200 acres or so of " Dutch glass " it has recently been estimated that some 600,000 crates of early lettuce, 3,000 tons of tomatoes, 2,250 tons of cucumbers and 200,000 melons are produced annually.

COMMONWEALTH AGRICULTURAL BUREAUX PUBLICATIONS

In addition to the periodical and abstracting journals published by all Institutes and Bureaux in this organization, there appear from time to time various types of occasional publications containing reviews or bibliographies on questions of current importance in the agriculture of this country or other parts of the British Commonwealth.

List of Recorded Cotton Insects of the World. H. Hargreaves. 1948. 5*s*.

Names of insects arranged in systematic order, parts of the cotton plant attacked, and countries from which each species has been recorded.

Report of the Fifth Commonwealth Entomological Conference, July 22-30, 1948. 7*s*. 6*d*.

This report gives a detailed account of the Conference, together with conclusions and resolutions. There are also three appendices : a memorandum of the work of the Institute from 1935 to 1948 ; the proceedings of the committees set up by the Conference ; and a full account of the scientific meetings. The last appendix contains the text of the papers read and occupies 86 pp. of the report.

List of Common Tropical Plant Diseases. 1947. 3*s*.
This list aims at giving the common names of tropical plant diseases with Latin names of the causal organisms. The synonyms of each are given together with the correct author citation and place of publication of the binomial for the pathogen.

Bibliography of Systematic Mycology, 1947. 1*s*. 6*d*.
A list of publications on systematic mycology received or indexed during 1947.

Seed Production of European Vegetables in the Tropics. A. G. G. Hill. 2*s*.
The author analyses replies to a questionnaire sent to tropical countries. Future lines of work are outlined and lists of indigenous vegetables used in tropical countries are given.

Index to Horticultural Abstracts Volumes XI-XV, 1941-1945. 1949. 35*s*.
A comprehensive subject and author index of the abstracts or notes occurring in these volumes of horticultural abstracts dealing with more than 10,000 original articles. Indispensable for full use of abstracts.

The Technique of Breeding for Drought Resistance in Crops. T. Ashton. 1948. 2*s*. 6*d*.
Information relating to wheat, oats, barley, rice, grass species and various other crops, including data from numerous Russian sources.

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